



# **RHS Qualifications Awarding Body**

## **RHS Level 3 Diploma in Horticulture**

### **General Guidance Notes and Syllabus**

The Royal Horticultural Society, Qualifications Section,  
Wisley, Woking, Surrey GU23 6QB

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For an alternative format of this document, please call the Qualifications Section on 01483 226500 or email [qualifications@rhs.org.uk](mailto:qualifications@rhs.org.uk)

## 1 BACKGROUND STATUS

- 1.1 The RHS Level 3 Diploma in Horticulture was established in 2001 as part of a progressive programme of primarily vocational horticultural examinations run by the Royal Horticultural Society. These examinations are as follows:-

RHS Level 2 Certificate in Horticulture  
RHS Level 3 Advanced Certificate in Horticulture  
RHS Level 3 Diploma in Horticulture  
Master of Horticulture (RHS) Award

The RHS Level 3 Diploma in Horticulture is a modular qualification involving both theoretical and practical elements. In academic terms, it equates to two GCE 'A' levels or Year Two of an Edexcel National Diploma in Horticulture.

Candidates who successfully complete the RHS Level 3 Diploma in Horticulture and meet other criteria will be eligible to register as candidates for the Master of Horticulture (RHS) Award.

The RHS Level 3 Diploma in Horticulture is an accredited award granted through the Office of the Qualifications and Examinations Regulators (Ofqual).  
**Accreditation No. 100/5862/X.**

## 2 AIMS OF THE AWARD

- 2.1 Success in the RHS Level 3 Diploma in Horticulture recognises achievement in theoretical and practical aspects of horticulture.
- 2.2 As a result of success in the examination, candidates will be able to:-
- 2.2.1 Apply a broad range of horticultural skills and understanding to practical horticulture;
  - 2.2.2 Relate the practices of horticulture to their underlying scientific principles;
  - 2.2.3 Devise reasoned solutions to horticultural problems;
  - 2.2.4 Plan horticultural operations, execute plans and review achievement in order to develop future strategy.
- 2.3 Candidates who are successful in the award will hold a valuable vocational qualification with which to support job applications, achieve career enhancement and enter responsible horticultural business positions. The RHS Level 3 Diploma in Horticulture fulfils a major entry requirement for the Master of Horticulture (RHS) Award and provides a good foundation for further study.

### 3 COURSES OF STUDY

- 3.1 To give full coverage of the syllabus, a minimum of 180 tutor-led taught hours is recommended.

In devising a programme of study it will be helpful for students to have a course running over 2 years so that a wide range of seasonal operations can be seen in practice.

Particular attention should be given to the range of practical skills required by the examination. Such skills may be gained in a variety of ways and centres should consider regular practical sessions, short courses or workshops to ensure that candidates are well prepared for the practical examination.

### 4 INTERPRETATION OF THE SYLLABUS (See Appendix 1)

- 4.1 The syllabus is the basis for the written and practical examinations.

- 4.2 Candidates are not expected to have a detailed knowledge of unusual plants, crops or specialist techniques. Preparing candidates for the examination should involve providing a firm foundation in horticultural science and a good knowledge of horticultural practices. Candidates should understand and be able to apply current horticultural techniques and provide relevant examples of their use.

The content section of the syllabus for each unit will indicate the depth and breadth of knowledge required.

- 4.3 The RHS Level 3 Diploma in Horticulture examination will assume a knowledge of topical horticultural issues. Candidates should have an understanding of planning, legislation, protection and enhancement of the environment, and other matters that affect the horticultural industry generally. The ability to provide objective, critical appraisal of such issues will be an advantage.

- 4.4 Candidates should be aware that only **metric units** will be used, and all answers must be given using metric units.

- 4.5 Candidates will benefit from an appreciation of recent research work and developments that have been applied to horticultural practice.

- 4.6 The written examinations comprise a range of short answer and structured questions designed to cover the whole syllabus. A choice of structured questions is provided and the emphasis is on the opportunity for candidates to display their skills and understanding, rather than to seek out shortcomings or weaknesses. Candidates should be given regular practice in answering written examination questions, preferably using examples from relevant sections of previous RHS Diploma in Horticulture papers.

- 4.7

- 4.7.1 The practical examination is a free-standing module which tests a range of common practical skills. Candidates need to develop basic proficiency and should be encouraged to practice for such tests.

4.7.2 The practical examinations involve a selection of the following types of test:

- practical tasks involving bench and plotwork;
- identification of plants, pests, diseases, disorders and materials;
- aspects of mechanisation;
- mensuration exercises;
- crop and site appraisals;
- laboratory-orientated tests in fundamental techniques;
- oral questions.

4.7.3 Requirements of the practical examination are set out within the syllabus. (See Appendix 1)

## 5 THE EXAMINATIONS

5.1 The three written examinations are of modular format, with each examination lasting two hours. Each module will comprise 10 short answer questions, to be completed in half an hour, and 6 structured questions from which three must be answered including one from each component unit. All modules may be taken in one year or they may be taken individually. The third of the three required written modules will be one of the option modules not taken at the Advanced Certificate stage. There will be two written examination periods annually, in February and early July.

5.2. The one day practical examination module will be taken at an approved regional centre at dates to be notified. Success in the written modules is **not** a requirement of entry.

## 6 SCRIPT MARKING

6.1 RHS Examiners consider the most positive answers to be those which fulfil the following criteria:

- a) Relate specifically to the question set, and in the case of structured answers are illustrated by clearly labelled diagrams where appropriate;
- b) Include appropriate factual information;
- c) Are presented legibly, clearly and logically, with appropriate headings and paragraphs in the case of structured questions.

## 7 ELIGIBILITY

7.1 Registration is open to vocational horticulturists and dedicated amateurs.

7.2 Candidates must have been successful in the examinations for the RHS Level 3 Advanced Certificate in Horticulture before the RHS Level 3 Diploma in Horticulture can be awarded.

7.3 Candidates should be made aware of the need for broad practical experience in horticulture.

## 8 REGISTRATION REQUIREMENTS

- 8.1 The closing dates for entry of the written examinations are **30 November 2010** for the February 2011 examination session and **6 May 2011** for the July 2011 examination session. The closing date for the practical examinations are **31 March 2011**.
- 8.2 Registration may be by module or for the complete RHS Level 3 Diploma Certificate in Horticulture.
- 8.3 To enrol for the Examinations, entries will normally be made through the candidate's centre of study, to arrive no later than the closing dates.
- 8.4 Candidates will normally pay their fee direct to the centre of study. The fee is £45.00 (£ Sterling) per written unit and £120.00 (£ Sterling) for the practical unit. The fee is **not refundable**.
- 8.5 The written examinations will normally be taken at the Centre where a course of study is being followed. The practical examination will be held at regional centres approved by the RHS. The Society reserves the right to nominate where the candidate should attend.
- 8.6 Candidates needing to re-sit either the written or practical modules should enter through their centre and pay the fee per module in the same way as the first registration.
- 8.7 Please note, as a candidate it is your responsibility to ensure you have been entered for the examination.
- 8.8 Candidates who wish to defer their entry to another date may do so without incurring any penalties; provided RHS Qualifications is notified up to **6 weeks** prior to the examination. Inside of six weeks, candidates will lose the fee unless exceptional circumstances prevail (medical grounds or similar).
- 8.9 Candidates following distance-learning courses towards this examination should contact and enrol through the Examinations office at their local approved centre. If candidates require further information, they should contact RHS Qualifications on 01483 226500.
- 8.10 Candidates not enrolled on courses at their chosen Examination Centre may be subject to a nominal fee, payable directly to the college.
- 8.11 In exceptional circumstances, the Examination may be taken at a place other than the approved centre, under the supervision of a person acceptable to The Royal Horticultural Society. In such cases, an Exceptional Supervision Application Form should be requested from RHS Qualifications.
- 8.12 Candidates entered for the examination must bring photographic proof of identity before being allowed to sit the examination (driving licence or similar photo ID).
- 8.13 In order to avoid loss or delay in the post, your examination centre must be notified of any change of surname, address, or telephone number.

- 8.14 Candidates must be punctual for the examination and make allowances for unfamiliar journeys, car parking etc.

## 9 NOTIFICATION OF RESULTS

- 9.1 The results of the examination will be notified to centres during April for the February Examination series and September for the July series. The Practical results will be sent within four weeks of taking the examination. The results will be sent to candidates by their nominated centre. Candidates who pass the written and practical modules will receive a certificate indicating the grade of Pass. The regulatory authorities' logos on the certificates issued for the Qualification indicate that the qualification is accredited for England, Wales and Northern Ireland.
- 9.2 Centres will be notified by post, of their candidates' results in the Examination.
- 9.3 Centres will also be sent a list of their candidates' results which will include the overall mark gained by each candidate.
- 9.4 Candidates who are unsuccessful or who consider that their result was not as good as they expected should be aware that Examination Papers including the Examiners' Reports are available to download from the RHS website.

As well as the examination results in summary it will give general guidance, based on candidates' performance in that examination, on how higher marks might be achieved with specific comments on each question.

Please refer to Enquiries About Result Service, item 13, (page 8) for further information about the options for the clerical checking and remarking for individual candidates scripts.

## 10 QUALIFYING AND GRADING REQUIREMENTS

- 10.1 **Written Modules.**  
A **Pass** will be awarded to candidates who achieve an average mark between 50% and 69% for each of the written modules.  
A **Pass with Commendation** will be awarded to candidates who achieve an average mark of 70% or more for each written module.
- 10.2 **Practical Modules**  
A **Pass** will be awarded to candidates who achieve an average mark between 55% and 69%.  
A **Pass with Commendation** will be awarded to candidates who achieve an average mark of 70% and above.

## 11 PRIZES

- 11.1 Two prizes are available each year at the discretion of the examiners. The candidate who obtains the highest total marks in the examination as a whole is eligible for the Chittenden Award. The candidate who obtains the highest total mark in the practical examination is eligible for the James Bruce Award.

## **12 PREVIOUS EXAMINATION PAPERS**

- 12.1 Past examination papers are available to download free-of-charge from the RHS website. Alternatively, printed copies can be ordered for a fee from the Qualifications Section.

## **13 ENQUIRIES ABOUT RESULTS SERVICE**

- 13.1 An Enquiry about Results Service administered by RHS Qualifications is available to candidates.
- 13.2 The service provides two options which will be at a cost to the candidate, payable to the Society. Re-mark £40.00 per unit. Re-mark and Report £60.00 per unit.
- 13.3 Should the findings result in a change of grade, the candidate's fee will be refunded.
- 13.4 Applications for this service should be made through the examination centre. All centres have been provided with full details of this service.

## **14 REASONABLE ADJUSTMENTS**

- 14.1 Applications for Reasonable Adjustments should be made through the centre providing the course of study.
- 14.2 Evidence should be provided at the time of entry for the examination. However, if this is not available at the time of entry, it must be submitted no later than 31 December for the February examination and 29 May for the June examination.
- 14.3 All centres have been provided with full details and application forms for this service.

## **15 RHS QUALIFICATIONS POLICIES**

- 15.1 The conduct of RHS Examinations is covered by the RHS Qualifications Equal Opportunities policy, Customer Service Statement and Appeals Policy. Copies of the above policies are available from RHS Qualifications on request. Alternatively, copies can be obtained through our website:  
<http://www.rhs.org.uk/Courses/Qualifications/RHS-qualification-policies>
- 15.2 The Council of the Royal Horticultural Society reserves the right to modify the Regulations. In any question of interpretation the decision of the Council is final.



## 16 COMMUNICATION

- 16.1 Request about the Royal Horticultural Society's other qualifications and any correspondence relating to RHS Qualifications, should be addressed to:

RHS Qualifications,  
The Royal Horticultural Society,  
Wisley,  
Woking,  
Surrey  
GU23 6QB.

Telephone: 01483 226500 email: [qualifications@rhs.org.uk](mailto:qualifications@rhs.org.uk)

## THE RHS (LEVEL 3) DIPLOMA IN HORTICULTURE SYLLABUS

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## Module F (Compulsory)

**Unit Title: Horticultural Environment and Ecology**

**Unit Code: J/103/6007**

**Unit Value: 1**

**Unit Level: Diploma**

### **Description of Unit:**

This unit examines the links between climate, plant distribution and development, and assesses the impact of other environmental factors on the growth and physiological adaptations of plants. The role of plants within different ecosystems is reviewed, and factors affecting the conservation of wildlife and plants are considered.

### **Summary of outcomes**

1. Relate scientific principles to horticultural practices.
2. Role of plants within ecosystems and plant communities.
3. Investigation of environmental and topographical factors on plant growth and development.
4. Effects of climate and soils on the distribution of plant species.
5. Ecological system degradation and conservation.
6. Risk assessments.

### **Content**

#### **Identifying safe health and working practices at all times.**

1. **Relate scientific principles to horticultural practices.**

Wherever possible horticultural science should be related to horticultural practices.

2. **Role of plants within ecosystems and plant communities.**

Plants as producers within the energy cycle. Plant associations, the effect of competition and climax association on the success of plants, and dominant species. Plant succession processes, (hydrosere, xerosere and secondary succession) allogenic and autogenic. Open and closed plant communities; semi-natural vegetation. Response of plants to natural and man made environmental stresses such as toxicity levels of minerals and pesticides. Ecosystems (eg woodlands, grassland, moorland, aquatic, coastal, heathlands and mountains).

3. **Investigation of environmental and topographical factors on plant growth and development.**

Abiotic (climatic, physiographic and edaphic) environmental factors to include temperature, light, windspeed, rainfall, soil type, pH, pollution (acid rain, methane, carbon dioxide, nitrates), reclamation. Measurement and monitoring of environmental factors, manual and computer based. Use of meteorological monitoring and data production, to include: temperature zones, timing of first and last frosts, windspeeds and direction, sunshine hours,

light values and water deficit. Effect of environmental conditions on plant growth. Plant modifications to withstand extreme environmental conditions arctic/alpine, arid, wet, shaded, salty and nutrient deficient habitats (xerophytes, hydrophyte and halophyte). Global and man made changes in environmental conditions.

#### **4. Effects of soil and climate on the distribution of plant species.**

Weather and climate of the British Isles: island climate, westerly influence of weather, proximity to continental mass. Typical cyclonic/depression and anticyclonic/high pressure seasonal weather patterns. Effects of soil types and texture, geography, weather and climate on the distribution, selection and growth of plants to include aspect, altitude, rain shadows, latitude and longitude, maritime influence, gulf stream effect, drainage. Atlas 2000: BSBI (Botanical Society of the British Isles) mapping of British plants.

#### **5. Ecological system degradation and conservation.**

Impact of horticultural practices to include protected and intensive cropping, organic growing systems. Planning regulations, environmental impact analysis and assessments. Grants for conservation projects. Wildlife conservation: threats to wildlife habitats including destruction of hedgerows, wildlife corridors. Policies for the conservation of plants and gardens: CITES (Convention on International Trade in Endangered Species); seedbanks; NCCPG (National Council for Conservation of Plants and Gardens), SSSI (Sites of Special Scientific Interest). Plant Collection and endangered species, Agenda 21. Recycling of waste.

#### **6. Risk assessments.**

Associated health and safety and safe working practices related to plant ecology and the environment. To include safety clothing where appropriate.

# Horticultural Environment and Ecology

Unit Level: Diploma

Unit Value: 1

## Learning outcomes:

1. Understand the relationship between scientific principles and horticultural practices.
2. Investigate the role of plants within ecosystems and plant communities
3. Investigate the effects of environmental and topographical factors on plant growth and development.

## Assessment criteria

- 1.1 Relate scientific principles to horticultural practices.
- 2.1 Explain how the development, structure and function of an organism depends on the interaction of that organism with its environment.
- 2.2 Define the terms ecosystem, open and closed plant communities, semi-natural vegetation, dominant species, climax association.
- 2.3 Explain the importance of plants as energy producers within ecosystems.
- 2.4 Describe the effects of plant association and competition on the succession of plants.
- 2.5 Describe how plant communities respond to environmental stresses.
- 3.1 Describe the effects of a range of abiotic environmental factors, on plant growth and development.
- 3.2 Describe the sources and nature of pollutants and possible effects on plants.
- 3.3 Explain the importance of monitoring abiotic environmental factors.
- 3.4 Evaluate the use of meteorological records in relation to plant growth and development.
- 3.5 Evaluate the methods by which environmental conditions can be manipulated to improve the growth and development of plants.

- 3.6 Describe plant modifications to withstand extreme environmental conditions.
- 3.7 State the factors affecting the choice of plants for garden or landscape sites with extreme conditions.
- 3.8 Define the terms: xerophyte, hydrophyte and halophyte.
- 3.9 Describe the structure and function of xerophytes, hydrophytes and halophytes.
- 3.10 Describe how xerophytes, hydrophytes and halophytes can be utilised in garden or landscape situations.
- 3.11 Describe the significance of xeromorphy in temperate zone plants and its importance in the garden or landscape situation.
- 4. Examine the effects of soil and climate on the distribution of plant species
  - 4.1 Describe the weather and climate of the British Isles.
  - 4.2 Relate plant distribution, growth and natural selection to soil, geography, weather and climate.
  - 4.3 State how soil, geography, weather and climate affect the horticulturist's selection of plants for any specific growing location.
- 5. Understand the processes of ecological system degradation and conservation.
  - 5.1 Describe how the environment may be affected by a range of horticultural practices.
  - 5.2 Explain how planning, environmental assessment and impact analysis may contribute to the conservation process.
  - 5.3 State the major sources of grant aid available to support environmental conservation on horticultural sites.
  - 5.4 Review the role of national and international organisations in the conservation of plants and gardens.

- 6. Undertake risk assessments
  - 6.1 Determine the elements of risk associated with operations associated with this unit.
  - 6.2 Identify safe working practices and appropriate protective equipment.

## Module F (Compulsory)

**Unit Title: Resource Management in the Horticultural Enterprise**

**Unit Code L/103/6008**

**Unit Value: 2**

**Unit Level: Diploma**

### **Description of Unit:**

This unit provides the resource management knowledge required for a supervisory position or for a self employed person. It includes related legislation, communication skills and management of human and physical resources.

### **Summary of outcomes**

1. Current legislation and codes of practice relating to horticulture and the working environment.
2. Effective communication in personnel management.
3. The role of human resource management in the horticultural enterprise.
4. The role of physical resource management in the horticultural enterprise.
5. The role of records and accounts in the small business.
6. The place of the horticultural industry within the economy.

### **Content**

#### **Identifying safe health and working practices at all times.**

#### **1. Current legislation and codes of practice relating to horticulture and the working environment.**

Health and safety legislation, The Food and Environment Protection Act (FEPA), Control of Pesticides Regulations (COPR), The Control of Substances Hazardous to Health Regulations (COSHH), the use of personal protective equipment (PPE) and codes of practice. Risk assessments. Plant conservation and environmental legislation. Sites of Special Scientific Interest, National Parks, areas of outstanding natural beauty. Plant health legislation, passports, and notifiable diseases. Seed regulations: percentage germination and purity. Plant Breeders Rights. Employment legislation: grievance and disciplinary procedures, job descriptions. Finance, welfare and insurance. Consumer legislation. Food safety legislation.

#### **2. Effective communication in personnel management.**

Structure of organisations, efficiency of communications, barriers to effective communication. Verbal and non-verbal communication (including Information and Communication Technology software), formal and informal communication. Report writing. Interpersonal skills. Decision making. Interview skills and preparation of technical questions.



**3. The role of human resource management in the horticultural enterprise.**

Staff recruitment and selection, induction and training. Customer care. Presentation skills. Use of e-mails, word processing and presentation software, telephone and facsimile. Problem solving. Role of the supervisor. Motivation, objective setting. Time management and delegation. Job descriptions, contracts, staff induction, appraisal and development techniques. Staff development. Incentives and job satisfaction. Team building.

**4. The role of physical resource management in the horticultural enterprise.**

Record keeping. Crop planning, maintenance schedules. Monitoring physical resources (including use of ICT). Optimum use of resources. Procurement and sourcing materials. British Standards, quality specifications, monitoring quality. Tenders, quotes, specifications and contracts – preparing, monitoring and controlling.

**5. The role of records and accounts in the small business.**

Sources of finance – banks, grants, mortgages, private finance; short and long term loans. Accounts, taxation, National Insurance, Value Added Tax. Insurance. Budgetary control. Cash flow. Use of spreadsheets, databases and financial software.

**6. The place of horticulture within the economy.**

Structure and organisation of UK horticultural enterprises. The horticultural and related industries, amenity, service and production. (Location. Workforce. Value). Marketing of services and products. Pricing and promotions. Competition, imports, exports. Roles of national organisations to include; professional bodies, trade organisations, government and non-government organisations. Research, development, advisory, education, training and charities. European Union and international trade. Employment opportunities.

# Resource Management in the Horticultural Enterprise

Unit Level: Diploma

Unit Value: 2

## Learning outcomes

1. Understand current legislation relating to all aspects of the working environment.

## Assessment criteria

1.1 Evaluate the current Health and Safety legislation and relate it to one area of horticulture.

1.2 Evaluate the current consumer legislation and relate it to one area of horticulture.

1.3 Evaluate the current employment legislation and relate it to one area of horticulture.

1.4 Evaluate the current plant health legislation and relate it to one area of horticulture.

1.5 Evaluate the current plant conservation and environmental regulations and relate them to one area of horticulture.

1.6 Evaluate the current plant conservation and environmental regulations and relate them to one area of horticulture.

1.7 Evaluate the current regulations relevant to sale of seeds and plants and relate them to one area of horticulture.

1.8 Evaluate the food safety legislation and relate it to one area of horticulture.

2. Define the importance of, and need for effective communication.

2.1 Explain the effect of the structure of an organisation on communication or relationships between individuals.

2.2 Analyse two alternative methods of improving the efficiency of communication.

2.3 Evaluate the role of communication in customer relations.

2.4 Describe the processes involved in selecting and interviewing staff.

- 2.5 Describe the benefits and limitations of using ICT software when making a presentation
- 2.6 Describe the successive stages in decision making.
- 2.7 Describe the successive stages in problem solving.
- 3. Examine the role of human resource management in a horticultural enterprise
  - 3.1 Describe the role of the supervisor in achieving the aims of the organisation.
  - 3.2 Describe the elements of a staff development strategy.
  - 3.3 Explain the importance of the evaluation of staff induction and training processes.
  - 3.4 State the importance of job descriptions and evaluate their relationship to staff appraisal and development.
  - 3.5 Explain how effective team building is achieved.
  - 3.6 Explain the benefits of motivation in a workforce.
  - 3.7 Evaluate the benefits of time management to the individual and the organisation.
- 4. Examine the role of physical resource management in a horticultural enterprise.
  - 4.1 Describe how record keeping can be used in monitoring the effective and efficient use of physical resources.
  - 4.2 Describe two stock control systems.
  - 4.3 Evaluate the application of ICT in resource management.
  - 4.4 Evaluate how the management of quality is intrinsic to the success of an enterprise.
  - 4.5 Describe two alternative methods of maintaining quality.
  - 4.6 Explain effective planning and maintenance of physical resources for a specified horticultural enterprise.

- 4.7 Describe the sourcing and procurement of physical resources for the specified enterprise.
- 4.8 Describe the processes involved in preparing specifications, quotes, tenders and contracts.
- 4.9 Describe the processes involved in monitoring and controlling tenders and contracts.
- 5. Understand the role of financial records and accounts in a small business.
  - 5.1 Describe sources of finance for small horticultural businesses.
  - 5.2 Explain the relationship between physical and financial planning.
  - 5.3 State the various forms of taxation and insurance which apply to small businesses.
  - 5.4 Describe the importance of taxation within budgetary planning.
  - 5.5 Describe the different types of financial records relevant to small horticultural businesses.
  - 5.6 Explain how a cash flow budget can benefit a business.
  - 5.7 Evaluate the use of ICT software in the financial monitoring and control of a small business.
- 6. Review the place of horticulture within the economy.
  - 6.1 Describe the structure and organisation of UK horticulture.
  - 6.2 Describe each major sector and state the factors affecting its location.
  - 6.3 Review the marketing strategy employed within a sector of horticulture.
  - 6.4 Describe pricing and promotion strategies within a sector of horticulture.
  - 6.5 State the role of professional bodies, trade organisations, government departments and non government organisations.

- 6.6 State the effects of European Union and International influences on one sector of the horticultural industry.
- 6.7 Describe the career opportunities available within horticulture.

Withdrawn Qualification

## Module G (Compulsory)

**Unit Title: Genetics, Plant Breeding and Systematic Botany**

**Unit Code: R/103/6009**

**Unit value: 1**

**Unit level: Diploma**

### **Description of unit:**

This unit provides the student with the necessary information to understand the principles behind the practices of plant breeding. It deals with basic genetics including mitosis and meiosis. The role of natural organisms and processes in plant breeding and development and the advantages of F1 and F2 hybrids is explored. The role of genetic modification in crops is reviewed. Systematic botany: characteristics of representative plant families and plant identification.

### **Summary of outcomes**

1. Relate scientific principles to horticultural practices.
2. Structure and function of genetic material.
3. Gamete production pollination and fertilisation in plants.
4. Mono-hybrid and di-hybrid inheritance in plants.
5. Current developments in plant genetics.
6. Systematic botany.

### **Content**

#### **1. Relate scientific principles to horticultural practices.**

Wherever possible horticultural science should be related to horticultural practices.

#### **2. Structure and function of genetic material.**

Structure of the nucleus and functions of its parts. Outline structure of chromosomes and DNA. Definition of the gene and explanation of protein synthesis. Sources and effects of genetic variation including sterility.

#### **3. Gamete production, pollination and fertilisation in plants.**

Comparison of processes of mitosis and meiosis. Advantages and disadvantages of self and cross pollination. Fertilisation. The role of biological and physical factors in plant breeding.

#### **4. Mono-hybrid and di-hybrid inheritance in plants.**

Prediction of F1 and F2 generations from mono-hybrid crosses. Functions and processes of back-crossing. Di-hybrid crosses without gene linkage. Comparison of or between two named plant breeding techniques and benefits of F1 hybrids.

**5. Current developments in plant genetics.**

Use of genetic modification in horticulture. The role of seed banks and conservation in plant breeding and preservation of genetic material.

**6. Systematic botany.**

Botanical and horticultural characteristics of plant families: Rosaceae, Asteraceae, Liliaceae, Poaceae, Ranunculaceae, Brassicaceae, Fabaceae, Solanaceae, Pinaceae. Floral formulae, floral diagrams and use of floral keys. Herbaria: their relevance to systematic botany.

# Genetics, Plant Breeding and Systematic Botany

Unit Level: Diploma

Unit Value: 1

## Learning outcomes

## Assessment criteria

- |    |  |     |   |
|----|--|-----|---|
| 1. | Understand the relationship between scientific principles and horticultural practices. | 1.1 | Relate scientific principles to horticultural practices.  |
| 2. | Describe the structure and function of genetic material.                               | 2.1 | Describe the ultrastructure of the nucleus and state the function of the components.                |
|    |  | 2.2 | Outline the structure of a chromosome and of DNA.   |
|    |  | 2.3 | Define gene and explain the process of protein synthesis.   |
|    |  | 2.4 | Describe sources and effects of genetic variation in plants.  |
| 3. | Describe gamete production in plants.  | 3.1 | Compare and contrast the processes of mitosis and meiosis.  |
|    |  | 3.2 | Describe the processes of pollination and fertilisation.  |
|    |  | 3.3 | State the sources and effects of genetic variation including sterility.                             |
|    |  | 3.4 | Describe the effects of self and cross pollination.   |
|    |  | 3.5 | Describe the role of biological and physical factors in plant breeding.                             |
| 4. | Explain the results of mono-hybrid and di-hybrid inheritance.                          | 4.1 | Determine the genotype and phenotype F1 and F2 results from mono-hybrid crosses.                    |
|    |  | 4.2 | Explain the process and functions of a back-cross (test cross).                                     |
|    |  | 4.3 | Determine the genotype and phenotype F1 and F2 results from di-hybrid crosses without gene linkage. |
|    |  | 4.4 | Describe and compare two named plant breeding techniques.   |
|    |  | 4.5 | Describe the advantages and   |



- disadvantages of using F1 hybrids in horticulture.
5. Review current developments in plant genetics.
    - 5.1 Review the major advantages and disadvantages of the genetic modification of plants.
    - 5.2 Evaluate the role of seedbanks and plant conservation in the preservation of genetic material.
  6. Investigate the role of systematic botany in horticulture.
    - 6.1 Describe the botanical and horticultural characteristics of a named plant family.
    - 6.2 Describe how a knowledge of the morphology of plants assists in their identification.
    - 6.3 Describe the relevance of herbaria to systematic botany.
    - 6.4 Describe the use of a floral key in the identification of plants.

## Module G (Compulsory)

**Unit Title: Plant Physiology II**

**Unit Code: J/103/6010**

**Unit Value: 2**

**Unit Level: Diploma**

### **Description of Unit:**

This unit builds on the Advanced Certificate unit on Plant Physiology and examines the physiology of flowering, dormancy in seeds and plants, artificial control of growth, growth regulation; plant growth and spacing; post harvest storage, transporting, retailing and shelf life of plant products.

### **Summary of outcomes**

1. Relate scientific principles to horticultural practices.
2. The physiology of growth, development and flowering.
3. Phytochrome.
4. Photoperiodism.
5. Effects of daylength control and temperature on flower bud initiation and development.
6. Dormancy in seeds and plants.
7. Dormancy breaking in seeds and plants.
8. Plant association and competition.
9. Respiration and post-harvest physiology.
10. Post harvest storage, transportation, retailing and shelf life.
11. Endogenous and synthetic growth regulators and their effect on plants.
12. Effects of plant association and competition on marketable quality and yield.
13. Risk assessment.

### **Content**

#### **Identifying safe health and working practices at all times.**

#### **1. Relate scientific principles to horticultural practices**

Wherever possible horticultural science should be related to horticultural practices.

#### **2. The physiology of growth, development and flowering**

Physiological age (juvenility), minimum leaf number and phytochrome. Difference between growth and development. Plant responses to day length.

#### **3. Phytochrome**

Phytochrome as a photoreceptor. Forms of phytochrome. Non active Pr and active Pfr and their photochemical convertibility. The phytochrome reaction, wave length, level of light and the light and dark reaction.

#### **4. Photoperiodism**

Seasonal flowering of plants. Artificial manipulation of photoperiod. Plant response group classification and day length response. Short day, long day and day neutral plants. Critical day length. Photo inductive cycles. Leaves as primary photoreceptors.

#### **5. Effects of day length control and temperature on flower bud initiation and development.**

Effects of temperature. The interaction of temperature and day length on plants. Bulb forcing. Use of documented information on the photoperiodic responses for the control of flowering in a named plant/crop.

#### **6. Dormancy in seeds and plants**

Causes of dormancy. Seed dormancy including physical and chemical inhibitors. Photoperiodic induction of dormancy in woody plants (deciduous). Possible effects of temperature and abscisic acid.

#### **7. Dormancy breaking in seeds and plants**

Seeds: scarification, physical and chemical; washing or soaking in water; stratification; combined treatment using low temperature and water; after ripening. Plants: photoperiodic manipulation including day length extension and night-break lighting; temperature; application of gibberellic acid; accumulation of cold units in dormancy breaking of rhubarb. Relationship to horticultural practices.

#### **8. Plant association and competition.**

Crop growth rate, net assimilation rate and leaf area index. Effects of crop spacing and plant density (population) on crop yield. Effect of crop canopy and spatial arrangement on photosynthetic efficiency. The effects of weeds as competitors. Choice of crop spacing and plant density in relation to plant parts to be harvested. Crop monoculture. Quality and yield potential in protected environments. Control of environmental factors. Marketable products for specific purposes.

#### **9. Respiration and post harvest physiology.**

The end products of respiration. Energy and the energy cycle. Aerobic and anaerobic respiration and their effects on growth and post harvest storage and shelf life.

#### **10. Post harvest storage, transportation, retailing and shelf life.**

Influence of pre-harvest conditions on post harvest product life, including nutrition and water. Post harvest control of temperature, oxygen, carbon dioxide and water loss. Specific environmental conditions for: fruit, trees and shrubs, vegetables and salads, cut flowers, pot plants, bedding plants, seeds and bulbs.

**11. Endogenous and synthetic growth regulators and their effect on plants.**

Endogenous growth regulators (plant hormones). Auxins and cytokinins and their role in stimulating cell division and enlargement. Gibberellins and the control of dormancy and extension growth. Abscisic acid and ethylene and effects on growth, dormancy breaking, flower induction, initiation and senescence.

Synthetic growth regulators. Synergy and antagonism. Seed dormancy and dormancy breaking. Vegetative propagation: root, stem and leaf cuttings. Tissue culture (meristem culture). Apical dominance. Growth retardation. Flower induction and initiation. Flower development, premature senescence. Extension of shelf life. Fruit set. Parthenocarp. Fruit ripening. Influence of hormonal changes. Early ripening.

**12. Effects of plant association and competition on marketable quality and yield.**

Crop growth rate, net assimilation rate and leaf area index. Effects of crop spacing and plant density (population) on crop yield. Effect of crop canopy and spatial arrangement on photosynthetic efficiency. The effects of weeds as competitors. Choice of crop spacing and plant density in relation to plant parts to be harvested. Crop monoculture. Quality and yield potential in protected environments. Control of environmental factors. Marketable products for specific purposes.

**13. Risk assessments.**

Carry out risk assessment and determine safe working practices and select appropriate personal safety clothing and equipment.

# Plant Physiology II

Unit Level: Diploma

Unit Value: 2

## Learning outcomes:

1. Understand the relationship between the scientific principles of this unit and horticultural practices.

2. Investigate the physiology of growth, development and flowering.

3. Examine the nature of phytochrome and its effect on flowering in the phytochrome reaction.

4. Relate photoperiodism and associated processes to the flowering of plants.

## Assessment criteria

1.1 Relate scientific principles to horticultural practices.

2.1 Explain why physiological age (juvenility), minimum leaf number, and phytochrome are responsible for changes in the plant from growth to development.

2.2 Differentiate between growth and development.

2.3 Describe physiological age and its relationship to flowering.

2.4 Explain the importance of minimum leaf number to the onset of flowering.

2.5 Assess a range of plant responses to day length (night length) in relation to flower induction.

3.1 Describe phytochrome as the photoreceptor for light absorption.

3.2 Describe the forms of phytochrome and their photochemical convertibility.

3.3 Explain the importance of level of light and wavelength on the light and dark reaction.

4.1 Describe how photoperiodic responses affect the seasonal flowering of plants.

4.2 Describe how artificial manipulation of photoperiods may be used to control flowering in a named plant/crop.

4.3 Explain the classification of plants according to day length response.

4.4 Define short day, long day and day neutral plants in relation to photoperiod.

- |    |      |   |
|----|------|---|
|    | 4.5  | Define critical day length in relation to response groups.  |
|    | 4.6  | Explain the importance of photoinductive cycles.  |
|    | 4.7  | Describe how leaves act as receptors in the flowering responses to photoinductive cycles.   |
| 5. |      | Understand the effect of temperature and its interaction with day length on flower bud initiation and development.  |
|    | 5.1  | Describe the effect of temperature on the onset of flowering and flower development.  |
|    | 5.2  | Explain the interaction of temperature and day length on flower bud initiation and development.   |
| 6. |      | Understand the causes of dormancy in seeds and plants   |
|    | 6.1  | Define dormancy in seeds and plants.  |
|    | 6.2  | Describe the physical causes of seed dormancy.  |
|    | 6.3  | Explain the photoperiodic induction of dormancy in deciduous woody plants.  |
|    | 6.4  | Describe the possible effects of temperature and abscisic acid on dormancy.   |
| 7. |      | Investigate methods of dormancy breaking in seeds and plants.   |
|    | 7.1  | Describe methods of dormancy breaking in seeds.   |
|    | 7.2. | Describe methods of dormancy breaking in plants.  |
| 8. |      | Understand plant association and competition and their effects on quality and marketable yield.   |
|    | 8.1  | State that the crop yield is related to crop growth rate C, which is increase in weight per unit of ground area and that as net assimilation rate (E) is the rate of increase in weight per unit area of leaf and leaf area (L) is the area of leaf per unit area of ground, $C=L \times E$ . |
|    | 8.2  | Explain that crop spacing (two dimensional-in-row distance between plants and distance between rows) and plant density will influence yield.  |
|    | 8.3  | Describe the effect of crop canopy and spatial arrangement on photosynthetic efficiency, light, water and nutrient availability and hence yield.  |
|    | 8.4  | Explain how crop spacing and plant  |

- density (population) is influenced by the part of the plant to be harvested: leaf, fruit, bulb, root etc.
- 8.5 Explain how choice of spacing and population may be used to manipulate the size of marketable product for specific purpose eg, fresh, freezing, canning or processing.
  - 8.6 Describe how the presence of weeds in a crop limits yield by providing competition for light, water and nutrients.
  - 8.7 Explain why monoculture and the exclusion of weeds is normally adopted in order to achieve maximum yields in horticultural crops.
  - 8.8 Describe how protected environments improve quality in addition to yield potential as compared with field crops.
  - 8.9 State the additional factors which may be controlled in protected environments in order to enhance quality and potential yield.
9. Understand the effect of respiration rate on post-harvest physiology.
    - 9.1 Describe the end products of respiration and the importance of energy in cell division and the energy cycle.
    - 9.2 Define aerobic and anaerobic respiration and their effects on growth and post-harvest storage and shelf life.
  10. Understand the environmental conditions required for post-harvest storage, transportation, retailing and shelf life.
    - 10.1 Describe the pre and post-harvest conditions that will ensure maximum shelf life of plants.
    - 10.2 Describe the control of environmental factors for storage, transportation and retailing.
  11. Investigate endogenous and synthetic growth regulators and their effect on plants.
    - 11.1 Describe how endogenous growth regulators (hormones) are responsible for cell division and enlargement, accelerating growth, inducing and breaking dormancy and flowering.
    - 11.2 Explain the action of auxins, gibberellins, abscisic acid and ethylene as growth regulators.

- 11.3 Distinguish between endogenous and synthetic growth regulators.
- 11.4 Explain synergy and antagonism in relation to synthetic growth regulators.
- 11.5 Explain how growth regulators affect seed dormancy and vegetative propagation.
- 11.6 Explain the use of growth regulators in tissue culture (meristem culture).
- 11.7 Explain how apical dominance is maintained or inhibited by growth regulator concentrations.
- 11.8 Explain how stem extension is controlled by auxins and gibberellins.
- 11.9 Explain how chemical growth regulators may be used to reduce plant height.
- 11.10 Explain how growth regulators affect flower induction (initiation) in association with photo and thermoperiodic changes.
- 11.11 Explain how ethylene affects flower development and premature senescence and how specific chemicals may be used to reduce ethylene production and enhance shelf life.
- 11.12 Explain how growth regulators influence fruit set and how parthenocarpic fruits are produced.
- 11.13 Explain how fruit set is improved by the application of synthetic growth regulators.
- 11.14 Explain how hormonal changes and an increase in sugar content influence fruit ripening.
- 11.15 Explain the use of chemical sprays to stimulate the release of ethylene resulting in early ripening.
- 11.16 State the value of premature leaf fall in nursery stock as a result of spraying with auxin.



- 11.17 Explain the value of ethylene as an auxin inhibitor in the induction of premature leaf fall.
12. Understand plant association and competition and their effects on quality and marketable yield and where relevant apply these effects to ornamental plantings\*.
- 12.1 Define each of the following: crop growth rate (C), net assimilation rate (E), and leaf area index (L)
- 12.2 State that crop yield is related to crop growth rate (C) and  $C = L \times E$ .
- 12.3 Explain that crop spacing (in-row distance between plants and distance between rows) and plant density (plant population) will influence crop yield\*.
- 12.4 Describe the effect of crop canopy and spatial arrangement on photosynthetic efficiency, light, water and nutrient availability and hence yield\*.
- 12.5 Explain how crop spacing and plant density (population) is influenced by the part of the plant to be harvested or plant part to be displayed: leaf, fruit, bulb, root etc.
- 12.6 Explain how choice of spacing and population may be used to manipulate the size of marketable product for specific purposes e.g. fresh, freezing, canning or processing\*.
- 12.7 Explain how the presence of weeds in a crop limits yield by providing competition for space, light, water and nutrients\*.
- 12.8 Explain why monoculture and the elimination of weeds is normally adopted in order to achieve maximum yields in horticultural crops\*.
- 12.9 Explain how protected environments improve quality in addition to yield potential as compared with field crops.
- 12.10 State the additional factors which may be controlled in protected environments in order to enhance quality and potential yield.

- 13. Undertake risk assessments.
  - 13.1 Determine the elements of risk in all the practical operations associated with this unit.
  - 13.2 Identify safe working practices for the operations identified, to include personal protective equipment and clothing.

## Module H (Compulsory)

**Unit Title: Practical Horticulture II**

**Unit Code: L/103/6011**

**Unit Value: 2**

**Unit Level: Diploma**

### **Description of Unit:**

The unit requires a student to develop a capability in practical horticultural skills and the management of horticultural situations.

### **Summary of outcomes:**

1. Specify horticultural assessments and carry out calculations.
2. Assessment of sites and operations for risk.
3. Assess the condition of machinery and equipment and carry out routine maintenance or calibration.
4. The organisation of propagation of a range of plants.
5. Demonstrate routine maintenance of plants and hard and soft features.
6. Determine the future management of a given area of plants, hard and soft features.
7. Identify seeds and plants.
8. Identification of weeds, pests, diseases and disorders and strategies for their control.
9. Identification of plant tissues.
10. Identification of a range of horticultural equipment, materials and sundries.
11. Planning exercises.

### **Content**

#### **1. Specify horticultural assessments and carry out calculations.**

Specify appropriate assessments of physical, biological and chemical properties of soil and interpret the results for horticultural practices. Calculation of liming materials required for stated area using tables provided. Calculation of fertiliser requirements (using Agricultural Development and Advisory Service tables and laboratory soil analysis reports provided, where appropriate). Liquid feed calculations. Mensuration and calculations for crop utilisation, sports facilities, ornamental gardens, plant density, heat loss from protected structures, ventilation requirement and fumigation requirements. Irrigation requirements.

#### **2. Assessment of sites and operations for risk.**

The assessment of sites and operations for risks e.g. use of chainsaw, pedestrian controlled rotary cultivator, attaching plough to tractor, use of brush cutter or strimmer, use of tractor and trailer, use of knapsack sprayer, two people loading irrigation pipes onto trailer, use of pedestrian controlled mower in location in which public are present. Assess the safe use of ladders/access equipment. Assess and demonstrate safe lifting and carrying techniques e.g. bricks, pavers.

**3. Assess the condition of machinery and equipment and carry out routine maintenance or calibration.**

Assess the condition of a powered implement and comment on effects of using it in such a condition and of maintenance, adjustment and/or repairs necessary to make the implement suitable for use: e.g rotary cultivator, cylinder mower, rotary mower, grading machinery, potting machine, precision seeding machinery, fertiliser applicator, planting machinery, sprayers, granule applicator, brush cutter, hedge cutter, chipper/shredder, chain saws.

Assess the condition of equipment and comment on effects of using it in such a condition and of maintenance, adjustment and/or repairs necessary to make the implement suitable for use: Knapsack sprayer, hand tools, secateurs, knives, propagation equipment, irrigation systems, heating, ventilation and lighting systems. Calibrate a knapsack sprayer. Adjust for use a range of horticultural machinery or equipment such as mowers, seeders, planters, potting machines, rotary cultivators.

**4. The organisation of propagation of a range of plants.**

Select appropriate containers or location and sowing media. Specify appropriate seed treatments and specific requirements for successful seed raising. Select appropriate method, materials, rooting media and location. Propagate by layering, budding, grafting (whip and tongue and side veneer), stem cuttings, leaf bud and leaf petiole cuttings, leaf lamina cuttings. State the aftercare necessary for optimum success in germination and rooting.

**5. Demonstrate routine maintenance of plants and hard and soft features.**

For a range of amenity and production situations demonstrate routine maintenance to include pruning, supporting, tying, weed control, aeration, scarification, top dressing, fertiliser application, irrigation, mulching, stopping, disbudding, thinning. Maintenance of walls, fences, structures, pergolas, arches, patios, water features, rock gardens, steps, garden furniture and play areas.

**6. Determine the future management of a given area of plants, hard and soft features.**

Determine the future management for production (including protected environments) and amenity situations e.g. young bedding plants, newly potted pot plants or a recently established field crop; lawn, shrub border, herbaceous borders, wildflower meadows, semi-natural vegetation. Management techniques to include irrigation, nutrition, environmental control, weed control, pest and disease control, harvesting, grading and packing. Determine the future management of walls, fences, structures, pergolas, arches, patios, water features, rock gardens, steps, garden furniture and play areas.

**7. Identify seeds and plants.**

Identification of a range of cultivated plants using full botanical names. Use of floral keys for plant identification.

**8. Identification of weeds, pests, diseases, and disorders and strategies for their control.**

Use of the current approved chemical guide. Appropriate cultural and biological controls.

**9. Identification of plant tissues.**

Microscope slides of sections of leaf, stem and root tissues. Modifications to include root tubers, stem tubers, corms, contractile roots, tendrils, bulbs, stem bulbils, root nodules, thorns, phyllodes and cladodes.

**10. Identify a range of horticultural equipment, materials and sundries.**

**11. Planning exercises**

Crop planning, programming, purchasing exercises. Costing – Amenity and Commercial situations. Allocation of human and physical resources. Consideration of conservation issues; energy saving, waste recycling and green issues.

## Practical Horticulture II

Unit Level: Diploma

Unit Value: 2

<b>Learning outcomes:</b>	<b>Assessment criteria:</b>
1. Specify horticultural assessments and carry out calculations.	1.1 Specify assessments necessary to determine texture, pH and nutrient status of soil samples. 1.2 Utilise information to calculate lime requirement to change the pH of soil for one specified sample. 1.3 Calculate the fertiliser requirements for an area of land according to given criteria and measurements. 1.4 Carry out a range of horticultural calculations accurately.
2. Assess a situation for risks.	2.1 Identify potential hazards in a horticultural situation. 2.2 State how to reduce the hazards involved. 2.3 Demonstrate safe lifting and carrying techniques. 2.4 Determine elements of risk in all of the practical operations associated with this unit. 2.5 Identify and demonstrate safe working practices for the operations of this unit including use of personal protective equipment and clothing.
3. Assess the state of repair of a powered implement and carry out routine maintenance or calibration.	3.1 Examine a powered horticultural implement and report on its state of repair and possible maintenance necessary. 3.2 Comment on the effects of using the equipment in current condition. 3.3 Calibrate a knapsack sprayer. 3.4 Prepare a range of horticultural equipment for use.

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| 4. | Organise the propagation of a range of plants.  | 4.1 | Select appropriate media and containers for seed sowing.  |
|    |   | 4.2 | Specify seed treatments where necessary.  |
|    |   | 4.3 | State the aftercare necessary until pricking out for seeds sown.  |
|    |   | 4.4 | Select the appropriate method of vegetative propagation for a range of plants provided.   |
|    |   | 4.5 | Select the appropriate medium, facilities and location for propagating the range of plants provided.  |
|    |   | 4.6 | Demonstrate the appropriate method of propagation for a range of plants provided.   |
|    |   | 4.7 | State the necessary aftercare until establishment for the plants propagated.  |
| 5. | Carry out routine maintenance on the plants, and hard landscape features.                                       | 5.1 | Carry out the seasonal maintenance appropriate to the plants/situation indicated.   |
|    |   | 5.2 | Discuss with the examiner future work that may be necessary on the plants/ situation indicated.   |
| 6. | Determine future management of a given area of plants and hard or soft landscape features.                      | 6.1 | Determine the future management of a range of horticultural situations relating to growing plants (including soft landscape situations) for a given period of time. |
|    |   | 6.2 | Determine the future management of a range of hard landscape situations for a given period of time.   |
| 7. | Identify a range of seeds and plants.   | 7.1 | Identify giving full botanical names a range of plants and seeds.   |
|    |   | 7.2 | Use a floral key to identify a plant specimen.  |
| 8. | Identify a range of weeds, plant pests, diseases and disorders and state methods of their prevention & control. | 8.1 | Identify 10 weeds and state the cultural methods for their control.   |
|    |   | 8.2 | Use Approved Chemicals guide to determine chemical control of weeds identified.   |

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|     | 8.3  | Identify 15 plant pests, diseases and disorders.  |   |
|     | 8.4  | Determine the chemicals for control of 10 of pests and diseases using the Approved Chemicals guide. |   |
|     | 8.5  | Discuss with the examiner alternative methods of pest control.                                      |   |
| 9.  | Identify plant tissues and state their functions.                    | 9.1   | Using low power binocular microscope identify 3 plant structures or tissues.        |
|     |  | 9.2   | Identify a range of plant modifications.  |
|     |  | 9.3   | State the function of the above modifications.                                      |
| 10. | Identify a range of horticultural equipment, materials and sundries. | 10.1  | Identify and state the purpose of 10 horticultural sundries and items of equipment. |
| 11. | Carry out a planning exercise.                                       | 11.1  | Using information provided, carry out a horticultural planning exercise.            |
|     |  | 11.2  | Identify conservation issues considered in the above planning exercise.             |



## Module D (Option)

**Unit Title: Outdoor Plant Production**

**Unit Code: Diploma R/103/6012                      Advanced T/103/5810**

**Unit value: 2**

**Unit Level: Advanced Certificate or Diploma**

### **Descriptions of Unit:**

This unit requires students to use underpinning knowledge from other units to develop an awareness of the relationship between plant and soil science and outdoor plant production.

### **Summary of outcomes**

1. Fruit crop production.
2. Vegetable crop production.
3. Nursery stock production.
4. Cut flower production.
5. Organic growing.
6. Risk assessment.

### **Content**

#### **Identifying safe health and working practices at all times**

#### **1. Fruit crop production.**

Principles and practices of production for one each of tree fruit, cane fruit, bush fruit and strawberries. Effect and selection of rootstocks on tree fruit. Field preparation; planting, spacing and establishment; pollination, fertilisation and fruit set; crop support and training; frost protection; pest, disease, disorder and weed control; irrigation and nutrition; pruning. Mechanisation of systems. Harvesting, grading, post harvest storage systems, including controlled atmosphere storage, marketing. Packhouse equipment.

#### **2. Vegetable crop production.**

Principles and practices of production for a brassica, root, allium, salad and legume crop. Techniques to include field preparation; propagation spacing and establishment; field factor and germination percentages; crop scheduling; bed systems; rotation; continuity; protection; irrigation and response periods; nutrition; pest, disease, disorder and weed control; harvesting and storage techniques (where appropriate). Grading standards and marketing. Crop shelf life and post-harvest techniques. Production and harvesting and packhouse equipment.

**3. Nursery stock production.**

Principles and practices of production for a range of hardy plants to include a climber, shrub, tree, conifer and herbaceous plant; two of which should be from seed. Techniques to include field preparation; propagation and establishment; bare root and container systems; growing media; pest, disease, disorder and weed control; nutrition and irrigation; maintenance of stock plants; harvesting systems; mechanisation of container systems, packhouse equipment, grading.

**4. Cut flower production.**

Principles and practices of production of an annual, biennial and a perennial cut flower in the open. Techniques to include propagation and plant raising; planting/sowing; irrigation and nutrition; pest, disease, disorder and weed control; plant support and training; maintenance and harvesting.

**5. Organic growing.**

Field conditions to be met to achieve 'organic' status. Advantages to consumer of organic produce, organic techniques to include rotation; manurial systems; composting; cultural and biological pest, disease and weed control.

**6. Risk assessment.**

Risk assessment of outdoor crop production, harvest and storage systems. Identification of appropriate safe working practices and selection of appropriate safety clothing and equipment.

# Outdoor Plant Production

Unit Level: Advanced Certificate or Diploma

Unit value: 2

## Learning outcomes:

1. Describe the commercial production of a range of fruit crops.

2. Describe the commercial production and harvesting of a range of vegetable crops.

## Assessment criteria

1.1 Describe the effects of rootstocks and their selection for fruit growth.

1.2 Describe the production, harvesting and storage of a range of fruit.

1.3 State the optimum stage of harvesting for a range of fruit crops.

1.4 For a range of fruit crops relate the production, harvesting and storage techniques to horticultural principles.

1.5 Describe the EU grading schedule for one named top fruit and one named soft fruit crop.

1.6 Describe the mechanisation of the production and the harvesting systems for tree and soft fruit.

1.7 Explain how shelf life can be affected by pre and post-harvest treatment of crops.

1.8 State the main factors to be considered when equipping a packhouse to deal with tree fruit crops for storage and marketing purposes.

2.1 Describe the production, harvesting and storage of a range of vegetable crops.

2.2 State the optimum stage of harvesting for a range of vegetable crops.

2.3 Relate the production, harvesting and storage techniques of a range of vegetable crops to horticultural principles.

2.4 Describe the EU grading schedules for two named vegetable crops.

2.5 Describe the mechanisation of the production and the harvesting systems for a range of vegetables.

- 2.6 Explain how shelf life can be affected by pre and post-harvest treatment of crops.
- 2.7 State the main factors to be considered when equipping a packhouse to deal with vegetable crops for storage and marketing purposes.
3. Describe the commercial production of a range of nursery stock.
- 3.1 Describe the production of a range of crops grown from seed and by vegetative means.
- 3.2 Relate the production, harvesting and storage of nursery stock to the underlying horticultural principles.
- 3.3 Prepare a maintenance plan for the care of stock beds over the period of a year.
- 3.4 State the optimum stage of growth to harvest the above range of crops.
- 3.5 Describe the harvesting systems used for bare root transplants.
- 3.6 Differentiate between production techniques used with container grown, containerised and open ground plants.
- 3.7 Describe the mechanised systems that are available to the producer of container grown plants.
- 3.8 State the factors to be considered when equipping a packhouse to deal with nursery stock.
4. Describe the commercial production of a range of outdoor cut flowers.
- 4.1 Describe the production of a range of outdoor cut flowers.
- 4.2 Relate the production, harvesting and storage of outdoor cut flowers to the underlying horticultural principles involved.
- 4.3 Describe the harvesting systems.
- 4.4 State the optimum stage of development for harvesting the above range of crops.
- 4.5 Explain how the shelf life can be affected by pre and post-harvesting treatment of crops.

- 5. Assess the advantages and disadvantages of organic production systems.
  - 5.1 State the conditions that must be met by a grower to qualify for 'organic' status.
  - 5.2 Assess the advantages to the consumer of organic produce.
  - 5.3 Describe a range of organic growing techniques and systems.
- 6. Undertake risk assessments.
  - 6.1 Determine the elements of risk in all of the practical operations associated with this unit.
  - 6.2 Identify the safe working practices for the operations identified, to include personal protective equipment and clothing.

## Module D (Option)

**Unit Title: Protected Plant Production**

**Unit Code: Diploma Y/103/6013                      Advanced A/103/5811**

**Unit value: 1**

**Unit level: Advanced Certificate or Diploma**

### **Description of Unit:**

This unit requires students to build upon aspects of the horticulture and science core to provide a broad overview of the practices and processes involved in successful protected cropping. It will enable students to have a clear understanding of environmental control and plant growth within a protective environment together with a practical knowledge of plant husbandry techniques.

### **Summary of outcomes**

1. Structures for protected cropping.
2. Environmental control.
3. Cladding materials and their properties.
4. Irrigation and nutrition.
5. The relationship between production techniques and horticultural principles.
6. Harvesting and post-harvest technology.
7. Risk assessment.

### **Content**

#### **Identifying safe health and working practices at all times**

##### **1. Structures for protected cropping.**

Single and multi-span greenhouses: venlo, widespan, mansard, plastics clad tunnels. Shape of structures to maximise natural light transmission. Suitability of different structures for specific cropping depending on natural light transmission.

##### **2. Environmental Control.**

Measurement of environmental factors including natural light, temperature of the growing media and air, moisture, plant nutrients and carbon dioxide. Control of the environment (including computer controlled systems): Heating and ventilation systems, thermal screens and blackout, shading, humidity, supplementary lighting, day-length manipulation, irrigation and nutrition, CO<sub>2</sub> enrichment. Link to external weather station. Ability of systems to record data.

##### **3. Cladding Materials and their Properties.**

Factors affecting light transmission: shape and orientation. Cladding materials including glass, rigid and film plastics. Heat insulation and cost effectiveness; light transmission properties.

**4. Irrigation and nutrition.**

Methods of application. Systems to include: overhead spraylines, flood benches, capillary benches, trickle, seep hose. Liquid feed systems: injection and displacement.

**5. The relationship between production techniques and horticultural principles.**

Principles and practices of the production of tomatoes, lettuce, chrysanthemums, a named pot plant, bedding plants. To include planting and crop establishment, stopping, irrigation, spacing, disbudding, layering, trimming and training. Growth control: chemical and cultural. Chemical and cultural pest, disease and disorder control. Current legislation. Biological and Integrated Pest Management. Economic thresholds, beneficial agents, methods of introduction. To include major pests, diseases and disorders of crops identified. Crop Harvesting including stage of growth, shelf life, and post harvest treatments. Alternative systems to include nutrient film techniques and rock wool; plug raised and pricked-off bedding plants.

**6. Harvesting and post-harvest technology.**

EU Grading standards. Packaging, and marketing to include wholesale market, wholesaler, supermarkets, local retailers, export, contract. (as related to above crops).

**7. Risk assessment.**

Risk assessment of protected crop production, harvest and storage systems. Identification of appropriate safe working practices, clothing and equipment.

# Protected Plant Production

**Unit Level:** Advanced Certificate or Diploma

**Unit Value:** 1

## Learning outcomes:

## Assessment criteria

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|---|-----|---|
| 1. Describe and evaluate the type and shape of modern growing structures.                       | 1.1 | Identify the main types of growing structures.  |
|   | 1.2 | Relate use of structures to shape and type of construction.                               |
| 2. Describe and evaluate the environmental controls in protected cropping.                      | 2.1 | Identify the range of environmental factors controlled within a growing structure.        |
|   | 2.2 | Describe the use of the equipment used to measure and monitor these factors.              |
|   | 2.3 | Name and describe a range of types of environmental control.                              |
|   | 2.4 | Evaluate the use of IT facilities for environmental control.                              |
| 3. Explain the nature of solar radiation, transmission properties of glass and its substitutes. | 3.1 | Describe the meaning of 'daylight' and explain the role of sunlight and diffused light.   |
|   | 3.2 | Relate time of year to the quantity and quality of available light.                       |
|   | 3.3 | Evaluate how the shape and orientation of a structure will affect light transmission.     |
|   | 3.4 | Assess the effectiveness of glass and cladding alternatives for light transmission.       |
|   | 3.5 | Describe the durability and insulation properties of glass and alternative materials.     |
| 4. Determine the water requirements of a crop and methods of irrigation.                        | 4.1 | Select and describe appropriate systems of irrigation for plants grown in situ.           |
|   | 4.2 | Select and describe appropriate systems of irrigation for container grown plants.         |
|   | 4.3 | Specify and evaluate systems for incorporating plant nutrients into the irrigation water. |



5. Relate horticultural principles to the production and harvesting of a range of crops.
- 5.1 Explain the effects of environmental control on the range of crops.
  - 5.2 Relate the essential features necessary for successful plant establishment and development to their underlying scientific principles.
  - 5.3 Describe the production of a range of crops under the following headings: Propagation and establishment. Crop development and maintenance. Control of pests, diseases and disorders and weed control where appropriate.
  - 5.4 State the optimum stage of growth for harvesting the range of crops.
  - 5.5 Describe the harvesting systems for protected crops.
  - 5.6 Explain how shelf life can be affected by pre and post harvesting treatment of the crop.
6. Evaluate the factors involved in marketing protected crops.
- 6.1 State the factors to be considered when marketing crops.
  - 6.2 Evaluate alternative marketing outlets available to growers of protected crops.
  - 6.3 Relate packaging and presentation to marketing.
  - 6.4 Assess the benefits to the grower and the customer of grading a crop prior to marketing.
7. Undertake risk assessment.
- 7.1 Determine the elements of risk in the practical operations associated with this unit.
  - 7.2 Identify the safe working practices for the operations identified, to include personal protective equipment and clothing.

## Module I (Option)

**Unit Title: Planning Layout and Construction of Ornamental Gardens**

**Unit Code: Diploma D/103/6014**

**Advanced F/103/5812**

**Unit Value: 2**

**Unit Level: Advanced Certificate or Diploma**

### Description of Unit

This unit requires an understanding of basic garden planning principles and practical procedures for site assessment, plan drawing and interpretation, specification and construction of hard landscape features in ornamental gardens. It also requires an appreciation of the relationship and inter-dependency between site factors, function and purpose of hard landscape features and the overall layout of ornamental gardens.

### Summary of outcomes

1. Site appraisal and interpretation.
2. Preparing site plans and specifications.
3. Influence of site characteristics.
4. The use of hard landscape features.
5. Setting out a site to scale plans and drawings.
6. Soil handling and storage.
7. Land drainage systems.
8. Ground preparation techniques.
9. Construction of paths and patios.
10. Construction of steps and ramps, dwarf walls and fences.
11. Risk assessment.

### Content

**Identifying safe health and working practices at all times.**

#### 1. Site appraisal and interpretation.

Site factors to include: dimensions, contours, orientation, aspect, altitude, exposure, shelter, soil, drainage, existing vegetation, structures, access, services, views, external factors.

#### 2. Preparing site plans and specifications.

Preparation of simple working drawings based on examples measurements and survey data. Correct use of scale, graphic symbols. Interpretation of site plans and specifications. Specifications to include: quantity, dimensions, type of features, surfaces and materials. Garden features to include: grass areas, beds, borders, hedges, screens, specimen trees, paths, driveways, patios, decking, furniture, play areas, ramps, steps, walls, fences, gates, pergolas, archways.

**3. Influence of site characteristics.**

Site factors as in 1. Design styles and themes to include: formal, informal, traditional, contemporary, low maintenance, wildlife conservation.

**4. The use of hard landscape features.**

The role and purpose of and the contribution made by hard landscape features to include: plant containers, screens, rock, scree, water, paths, driveways, patios, decking, furniture, lighting, play areas, ramps, steps, walls, fences, gates, pergolas, archways. Hard surface materials to include: concrete, gravel, cobbles, bricks, natural and artificial stone and paving, bark, shredded rubber, crushed glass and reinforced grass areas.

**5. Setting out a site from scale plans and drawings.**

Interpret scale drawings and describe transfer of details to site: setting out boundaries and spot features; setting out levels; marking out squares, rectangles, circles, diamonds, ellipses and curvilinear areas. Draw up a construction schedule from drawings and specifications provided.

**6. Soil handling and storage.**

Excavation, storage and re-distribution of topsoil, and treatment of subsoil, during contouring, levelling and construction works.

**7. Land drainage systems.**

The relationship between soil texture and structure and soil draining specification; type, depth, spacing and backfill. Transfer of levels from site plans to achieve required depth and fall to outflow. The site factors determining a suitable and adequate outflow for garden use. Site uses to include: formal lawns, grassed play areas, plant areas, paths and driveways, large areas of porous and non-porous surface materials for frequent use. The safe, practicable use of natural water in the design of gardens.

**8. Ground preparation techniques.**

The treatment and cultivation of soil for different landscape purposes: hard surfaces and structures, planted areas, seeded and turfed grass areas. Soil cultivations related to soil type and condition: sand, clay and loam soils, dry and waterlogged sites.

**9. Construction of paths and patios.**

Ground preparation, grading and foundations required for a range of path and patio materials to include: concrete, gravel, bricks, natural and artificial stone and paving. Procedures for laying surface and edging materials on prepared foundation.

**10. Construction of steps and ramps, dwarf walls and fences.**

Foundations required for a range of materials to include: concrete, bricks, natural and artificial stone and paving; fencing materials to include post and rail, wire netting, close board and panels. Procedures for the construction on prepared foundations.

**11. Risk assessment.**

Risks associated with landscape site planning and construction practices. Use of safe working practices, adequate protective clothing and safe materials, machinery and equipment. Safety of visitors to site; identification of and exclusion from hazard areas.

Withdrawn Qualification

# Planning Layout and Construction of Ornamental Gardens

Unit level: Advanced Certificate or Diploma

Unit value: 2

<b>Learning outcomes:</b>	<b>Assessment criteria:</b>
1. Understand how to conduct a site appraisal and interpret the results.	1.1 State the main factors to be assessed for an overall site appraisal.
	1.2 Review the major attributes and limitations, which site factors may impose on garden planning and layout.
2. Produce and interpret site plans and specifications using basic survey measurements.	2.1 Produce scale drawings using survey data provided.
	2.2 Draft the specification for a range of garden features.
	2.3 Interpret scale drawings and specifications provided.
3. Explain how site characteristics may influence choice of garden design style.	3.1 Explain the influence of soil type, contour, exposure and drainage on choice of design style.
	3.2 Explain how a given design style may be used to enhance the attributes and offset the limitations imposed by the site.
	3.3 Explain how the proximity of a building may affect the planning and design of a garden.
4. Understand and evaluate the contribution made by hard landscape features to design and function.	4.1 Explain the role and purpose of a range of hard landscape features.
	4.2 Evaluate the contribution made by a range of hard landscape features to the overall design of a garden.
	4.3 Evaluate the use of a range of hard surface materials in the ornamental garden.
	4.4 Evaluate a range of surface materials for use in children's play areas.
	4.5 Evaluate a range of path, patio and driveway materials.

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| 5. | Describe the practical procedures for setting out a site to scale plans and drawings.   | 5.1 | Describe how scale drawings are interpreted to set out the boundaries of a site and the major features to be incorporated.                |
|    |   | 5.2 | Describe how contour lines and plan sections are used to set out the required levels on site.   |
|    |   | 5.3 | Describe how to mark out a range of geometric outlines on the ground.   |
|    |   | 5.4 | Draft an outline construction schedule using data and information provided.   |
| 6. | Describe and explain the reasons for correct soil moving and storage during construction works.   | 6.1 | Explain the importance of correct storage and re-instatement of topsoil during site construction.   |
|    |   | 6.2 | Review the range of tools and equipment used in contour adjustment.   |
|    |   | 6.3 | Explain the procedures involved in the levelling/contouring subsoil/topsoil.  |
| 7. | Explain the factors which determine the design and specification of land drainage systems and describe the procedures for setting out and installing land drainage. | 7.1 | Relate drain depth, type and spacing to soil structure and texture.   |
|    |   | 7.2 | Explain how the planned use of a site may affect the choice and specification of a land drainage system.                                  |
|    |   | 7.3 | Explain the factors, which determine a suitable outlet for a land drainage system.  |
|    |   | 7.4 | Describe how scale drawings are interpreted in order to set out the position of drains.   |
|    |   | 7.5 | Describe the excavation of trenches in order to achieve the required falls to the main outlets.   |
|    |   | 7.6 | Describe the selection, installation and back filling for a specified drainage system.  |
|    |   | 7.7 | Describe how a suitable natural water supply may be incorporated into the design of a garden and explain the essential safeguards needed. |

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| 8.  | Understand the requirement for a range of ground preparation techniques for different landscape features.   | 8.1  | Explain the requirements for the removal of topsoil and consolidation of areas for hard landscape features.   |
|     |   | 8.2  | Evaluate a range of primary ground preparation techniques required for different soft landscape features.   |
|     |   | 8.3  | Explain why methods of soil cultivation should take into account of soil type and soil condition.   |
| 9.  | Specify a range of materials and outline the procedures for the construction of paths and patios.   | 9.1  | Specify appropriate foundations for paths and patios under site conditions and uses.  |
|     |   | 9.2  | Outline the procedures for preparing the site and laying foundations for paths and patios under a range of site conditions.                                   |
|     |   | 9.3  | Specify a range of appropriate surface materials for paths and patios and relate to intended use and site conditions.   |
|     |   | 9.4  | Outline the procedures for laying a range of surface materials on prepared foundations.   |
|     |   | 9.5  | Specify appropriate edging materials to accompany a range of surfaces and situations and describe their installation.   |
| 10. | Specify a range of materials and outline the procedures for the construction of steps and ramps, dwarf walls and fences, for a range of site conditions and uses. | 10.1 | Specify appropriate foundations for steps and ramps, dwarf walls and fences, under a range of site conditions.  |
|     |   | 10.2 | Outline the procedures for preparing the site and laying foundations for steps and ramps, dwarf walls and fences, under a range of site conditions.           |
|     |   | 10.3 | Specify a range of appropriate materials for steps and ramps, dwarf walls and fences, and relate to intended use and site conditions.                         |
|     |   | 10.4 | Outline the procedures for laying a range of materials for steps and ramps, dwarf walls and fences, on prepared foundations under a range of site conditions. |

- 11. Undertake risk assessments.
  - 11.1 Determine the elements of risk in all operations associated with this unit.
  - 11.2 Identify safe working practices for any operations described above or relevant to include personal protective equipment and clothing as appropriate.



## Module I (Option)

**Unit Title: Restoring Established Ornamental Gardens**

**Unit Code: Diploma H/103/6015                      Advanced J/103/5813**

**Unit Value: 1**

**Unit Level: Advanced Certificate or Diploma**

### Description of Unit

This unit uses and builds on the understanding and practical knowledge contained in 'Planning, Layout and Construction', and will in general apply to ornamental gardens of one or two hectares or less. It requires an understanding of methods and criteria for the appraisal of the condition of established plantings and features, and a thorough knowledge of the practical procedures used in remedial work and the restoration of ornamental gardens. It also requires an outline of the history of the planting and design of ornamental gardens, and the importance of heritage gardens in the United Kingdom.

### Summary of outcomes

1. Surveying and recording the dimensions, layout and content of a garden; site factors.
2. Assessment of the type and condition of plantings and features.
3. Selection of plantings and features for retention.
4. Analysis of findings and preparation of outline work programme.
5. Recognition and repair of faults in land drainage systems.
6. Renovation of a range of hard landscape features.
7. Improvement of plantings and their future maintenance.
8. Design styles and periods in the history of U.K. ornamental gardens; plantings and features of particular interest; heritage gardens and relevant organisations.
9. Risk assessment.

### Content

#### Identifying safe health and working practices at all times.

1. **Surveying and recording the dimensions, layout and content of a garden; site factors.**

**Survey problems:** obstruction of site-lines by structures and vegetation; overgrown boundary hedges, beds and borders; obscured paths and grassed areas.

**Preparation** of simple scale-drawings based on example measurements and survey data.

**Measurement** and recording - tabulated and referenced lists of recorded measurements for: grassed areas, beds, borders, hedges, screens, shrubberies, group and specimen trees, paths, driveways, patios, terraces, ramps, steps, walls, fences, gates, pergolas, archways, rock gardens, water features, statuary, small structures.

**Site factors:** dimensions, contours, orientation, aspect, altitude, exposure, shelter, soil type and condition, drainage, access points, overhead and underground services, internal and external views.

## 2. Assessment of the type and condition of plantings and features.

**Criteria:** correct planting situation for species; appropriate vegetative growth, flowering, size and shape; not over-mature; absence of suckers, reverted shoots; absence of competition from adjacent plants, invasive weeds, overhead branches; freedom from debilitating pests, diseases and disorders.

**Condition** of hard landscape features (as listed in 1. above): safe structure, not deteriorating; use(s), function and contribution to the garden retained; appearance satisfactory.

## 3. Selection of plantings and features for retention.

**Original purpose and use:** may be affected by plant growth or neglect; external and internal views may be lost; privacy may be lost; open recreational areas may be reduced or grown over; plant and feature losses may alter character.

**Intended purpose and use:** may differ from original; may require the removal of some plantings or features; may influence choice of plantings or features for retention. Collective contribution of plantings and features which can be retained, including those of high value, may not be satisfactory or permit easy renewal of those not retained.

**Unintended losses** of plantings and ornamental features: in all cases plot, record and clearly mark on site, be alert to dormant herbaceous species; protect if necessary, take action to ensure correct conditions prevail, confirm identification and rarity with competent authority, label correctly and record, consider propagation or removal to a safer location.

**Examples (plantings):** less common or particularly fine specimens of mature trees and shrubs, "Champion Trees"; collections of one genus or group - old shrub roses, lilac, rhododendron, dwarf conifers, iris x germanica, hemerocallis, primula, geranium, narcissus, ferns; hedges and topiary; fine lawns; established groups of naturalised and native wild plants.

**Examples (ornamental features):** fine statuary, ornamentation, natural stone paving, ironwork, wood carving, fountains, arches, seats.

## 4. Analysis of findings and preparation of outline work programme.

**Temporary safeguards for plants and features:** temporary removal to a safe position; provide protective fencing or wrapping; branch removal or tying back; cover hard surfaces and grassed areas as appropriate to the traffic crossing them; provide protective covering for steps, ramps, walls and structures.

**Factors to be taken into account:** existing and temporary access points, routes for the extraction of bulky waste, internal movement of bulky materials, avoidance of subsequent damage to features and planted areas already restored.

**Seasonal factors:** exposure to sun, drying or cold winds, risk of flooding, frost and ice, daylength.

## 5. Recognition and repair of faults in land drainage systems.

**Symptoms:** area generally badly drained; wet soil or ponding in patches; discoloured patches in turf.

**Factors:** silting; inadequate falls; rise in water table; obstruction at outflow or other locations; tile drains out of horizontal or vertical alignment; drains collapsed; soil water unable to reach drain; soil capping.

## 6. Renovation of a range of hard landscape features.

**Faults:** stone or slab paths uneven; gravel driveways compacted and weedy; stone steps cracked and broken; dwarf walls out of vertical alignment; concrete ponds leaking; wood panel fences leaning; a pergola supporting climbing roses partly collapsed.

## 7. Improvement of plantings and their future maintenance.

**Environmental problems:** excessive shade from mature trees - cut back trees or replant with shade-bearers; soil acidity - correct pH; nutrient deficiency - restore correct levels; dry impoverished soils - apply organic matter or replant with suitable species.

**Invasive species:** sycamore, bramble, ivy, ground elder, creeping buttercup,

**Plant health:** Honey fungus, coral spot, rose mildew, powdery mildew, apple scab, rhododendron bud blast, bacterial canker, fairy ring fungus, woolly aphid, holly leaf miner, stem eelworm, brown scale, yew scale.

**Pruning methods:** removal of dead and diseased growth; shaping, reducing, hard cutting back, thinning crowded growth; renovation of yew hedges.

**Maintenance techniques:** installed trickle irrigation systems; bark, shingle and perforated plastic mulching; the use of strimmers, motorised hedge cutters, ride-on mowers.

## 8. Design styles and periods in the history of U.K. ornamental gardens; plantings and features of particular interest; heritage gardens and relevant organisations.

**Development trends:** formal/informal, knot garden, parterre, cottage garden, carpet bedding, herbaceous borders, rock garden, scree, wild garden, wildflower meadow, the 'garden room'.

**Plant introductions:** Horse chestnut (early 16th C.), Tulip tree (late 17th C.), Maidenhair tree (mid 18th C.), Lawson cypress (mid 19th C.), Dawn Redwood (mid 20th C. - 1947), *Rosa multiflora* (1816), *Choisya ternata* (1825), *Ribes sanguineum* (1826), *Clematis montana* (1831), *Viburnum plicatum* (1844), *Hydrangea paniculata* (1864).

**Garden design styles:** Tudor, Dutch, Italian, Victorian, Modern.

**Organisations:** English Heritage, Garden History Society, National Trust, Association of Garden Trusts (and County Gardens Trusts).

## 9. Risk assessment.

Risks associated with garden restoration and renovation practices. Use of safe working practices, adequate protective clothing and safe materials, machinery and equipment. Safety of visitors to site; identification of and exclusion from hazard areas.

# Restoring Established Ornamental Gardens

**Unit level:** Advanced Certificate or Diploma

**Unit value:** 1

<b>Learning outcomes:</b>	<b>Assessment criteria:</b>
1. Describe basic methods for the survey and recording of the layout and content of an established ornamental garden, and explain the importance of detailed information including assessment of site factors.	1.1 Describe the basic measurement, survey, and production of a scale drawing showing the layout of an established garden. Explain how the chief problems which may be encountered may be overcome.
	1.2 Describe the individual measurement and recording of a range of plantings and features.
	1.3 Explain how the assessment of a range of topographical and prevailing environmental factors, within and beyond the garden, can help restoration planning.
2. Understand the need for the assessment and recording of the type, condition and future potential of a range of plantings and features in an established ornamental garden.	2.1 Explain the need to draw up and record a complete and detailed list of plantings and features.
	2.2 Explain why it is necessary, at an early stage, to note mature trees and large structures, and to seek expert help in ensuring their safe condition.
	2.3 List and describe, using examples, the main criteria used in assessing the health, condition and future life expectancy of all plantings.
	2.4 Explain why it is necessary to assess the condition and safety of a range of hard landscape features in the garden.
3. Explain the main criteria used to select plantings and features for retention in the restored garden.	3.1 Explain why it is important to consider at an early stage, the intended purpose and uses of both the original and the restored garden.
	3.2 Explain why it is necessary to assess the contribution existing healthy plantings and sound or renovated hard landscape features will make in the restored garden.

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|    |  | 3.3 | Understand the high ornamental value of some mature plant species and explain the effect this may have on restoration plans.   |
|    |  | 3.4 | Using examples, explain the need for immediate action to avoid the unintended loss or destruction of rare plants and valuable garden ornaments.                            |
| 4. | Understand the need to analyse the information collected and prepare an outline programme for the organisation of the garden restoration work. | 4.1 | Explain the need, before restoration work commences, to consider what safeguards may be necessary to protect all plantings and features to be retained.                    |
|    |  | 4.2 | Describe the use and installation of a range of temporary safeguards and precautions commonly employed.  |
|    |  | 4.3 | Explain the importance of carefully determining the order in which restoration work is to be undertaken and give examples of factors, which need to be taken into account. |
|    |  | 4.4 | Explain the need to take seasonal factors into account.  |
|    |  | 4.5 | Prepare an outline schedule for the restoration work from information provided.  |
| 5. | Recognise and explain the visible signs of the failure of old land drainage systems and describe remedial measures.                            | 5.1 | Describe the visible symptoms and explain a range of factors, which contribute to the ineffectiveness or failure of land drainage systems in gardens.                      |
|    |  | 5.2 | Describe effective measures, for each of the factors, for the repair and improvement of existing land drainage systems.  |
| 6. | Understand and describe the practical procedures necessary for the restoration of a range of hard landscape features.                          | 6.1 | Explain the need to carefully examine and assess the condition of retained hard landscape features and describe a range of commonly encountered faults.                    |
|    |  | 6.2 | Describe in outline an appropriate method for the correction and repair of these faults.   |

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| 7. | Understand the problems which may be encountered, and describe practical procedures for the improvement of retained hedges, plantings, and lawns. Evaluate the use of modern maintenance techniques in established gardens.  | 7.1 | Explain the need to carefully examine and assess the condition of retained hedges, group plantings and individual plants.  |
|    |  | 7.2 | Describe a range of associated environmental problems and the ways in which they can be overcome.  |
|    |  | 7.3 | Explain the effect of competition between plants of the same type and those of different species and describe how these may be overcome.   |
|    |  | 7.4 | Explain the effect of a range of invasive species and describe how these may be controlled.  |
|    |  | 7.5 | Describe, using examples, a range of plant health problems commonly encountered in neglected gardens and their treatment.  |
|    |  | 7.6 | Describe methods used for pruning overgrown shrubs, including hedges.  |
|    |  | 7.7 | Explain the basic operations for the improvement of neglected herbaceous plantings and ornamental lawns.   |
|    |  | 7.8 | Explain the benefits and limitations of the use in restored gardens of a range of modern maintenance techniques.   |
| 8. | Outline the history of U.K. garden design and the influence of plant introductions; evaluate an established ornamental garden in order to determine any particular design style or period, or plants of interest; explain the role of heritage gardens and relevant organisations. | 8.1 | Outline the main trends in the development of ornamental gardens in the U.K. from the sixteenth century to the present day, and the influence of the introduction of new plant species.                      |
|    |  | 8.2 | State the origin, period and one notable example in the U.K. of a range of generic garden design styles. Describe the main features of each, and the relative influence of contemporary plant introductions. |
|    |  | 8.3 | Explain the reasons why an established ornamental garden should be evaluated to determine its design style and period and to assess the importance of its plantings and features.                            |

- 8.4 Explain the terms 'heritage garden' and 'listed garden'. Outline the work of some organisations in the U.K. for research into garden history or undertaking heritage garden restoration.
- 9. Undertake risk assessment and identify safe working practices.
  - 9.1 Identify a range of hazards, which may be encountered when working within a neglected and overgrown established garden and describe precautionary measures which should be taken.

## Module J (Option)

**Unit Title: Establishment and Maintenance of Decorative Ornamental Turf**

**Unit Code: Diploma K/103/6016                      Advanced L/103/5814**

**Unit Value: 1**

**Unit Level: Advanced Certificate or Diploma**

### Description of Unit

This unit assumes an understanding of the underpinning knowledge from other units to develop and apply turf maintenance practices. It will enable students to maintain both fine lawn and amenity grassed areas.

### Summary of Outcomes

1. Establishment of grass from turf and seed.
2. Maintenance of turf areas.
3. Selection and use of turf machinery.
4. Turf weeds, pests and diseases.
5. Risk assessment.

### Content

**Identifying safe, healthy and environmentally sustainable working practices at all times.**

#### 1. Establishment of grass from turf and seed.

Selection, characteristics and suitability of grass species for a variety of uses include: fine and coarse amenity lawns, wildflower meadows. Advantages and disadvantages of establishing grass areas from turf and seed. Site drainage and preparation. Care during establishment period of newly seeded or turfed areas.

#### 2. Maintenance of fine turf areas.

Annual maintenance programme to amenity turf to include: mowing, scarification and verti-cutting, aeration (surface and deep), feeding, irrigation, renovation, over-seeding, top dressing.

#### 3. Selection and use of turf machinery.

Selection and use of a range of pedestrian and tractor mounted turf care equipment for both fine and coarse turf, to include: cylinder, rotary and flail mowers, fraise mowers, verti-cutters and scarifiers, sarrell rollers, drum spikers, deep aeration equipment, fertiliser distributors, top dressers, over-seeders, drag mats and brushes, sprayers, vacuums and blowers, rollers.



**4. Management of weeds, pests and diseases.**

Identification of a range of turf weeds and moss (see practical unit for range). Their significance to the appearance and use of turfed surfaces, chemical, biological and cultural methods of control. Identification of a range of turf pests, diseases and weeds. Pest and disease life cycle and environmental conditions favouring spread.

**5. Risk assessment.**

Risk assessment of turf establishment and maintenance practices. Identification of appropriate safe working practices, safety clothing and equipment fulfilling statutory regulations.

# Establishment and Maintenance of Decorative Ornamental Turf

Unit level: Advanced Certificate or Diploma

Unit value: 1

<b>Learning outcomes:</b>	<b>Assessment criteria:</b>
1. Describe the establishment of grass from turf and seed.	1.1 Describe the characteristics of grass species and evaluate these for a variety of uses. 1.2 Specify grass species to be used in seed mixes for different situations or purposes. 1.3 Evaluate the advantages and disadvantages of establishing grass areas from seed or turf. 1.4 Describe different turf drainage systems and evaluate their efficiency in removing water from the turf surface. 1.5 Relate the preparation and establishment of the seeded and turfed areas to underlying horticultural principles.
2. Review the maintenance of established grassed areas for a range of purposes and soil conditions.	2.1 Relate the annual maintenance of a mown grassed area and fine lawn to underlying horticultural principles. 2.2 Relate the end of season lawn renovation work required to usage and soil conditions. 2.3 Programme and describe the annual maintenance of an amenity lawn area. 2.4 Describe an annual fertiliser programme for fine and coarse turf, and explain how this may be affected by different uses and soil types.
3. Review the selection and operation of a range of turf care machinery.	3.1 Evaluate a range of pedestrian and tractor mounted turf care equipment. 3.2 Specify scarification reels for a range of uses. Specify aeration tines for a range of uses.

- 3.3 Evaluate the surfaces produced by a range of mowing equipment.
- 4. Demonstrate an understanding of the effect of a range of turf weeds, pests and diseases.
  - 4.1 Explain the significance of a range of turf weeds in relation to the quality of the grassed surface.
  - 4.2 Evaluate chemical and cultural methods of weed and moss control.
  - 4.3 Explain the significance for a range of turf pests and diseases in relation to the appearance and use of the grass surface.
  - 4.4 Relate the life cycles of a range of turf pests and diseases to environmental conditions.
  - 4.5 Evaluate chemical, cultural and biological methods in the control of turf pests and diseases.
- 5. Undertake risk assessment.
  - 5.1 Determine the elements of risk in the practical operations associated with the unit.
  - 5.2 Identify safe working practices for the operations identified, to include personal protective equipment and clothing.

## Module J (Option)

**Unit Title: Plant Selection, Establishment and Maintenance**

**Unit Code: Diploma M/103/6017**

**Advanced R/103/5815**

**Unit Value: 1**

**Unit Level: Advanced Certificate or Diploma**

### Description of Unit

The unit assumes an understanding of the underpinning knowledge from other units to develop and apply landscape maintenance practices. It will enable students to maintain a range of plants and borders.

### Summary of Outcomes

1. Selection and establishment of plants.
2. Selection and maintenance of alpine plants.
3. Selection and maintenance of aquatic and marginal plants.
4. Selection and establishment of plants for seasonal display.
5. Maintenance of herbaceous plants and their environment.
6. Maintenance of woody plants and their environment.
7. Risk assessment.

### Content

#### **Identifying safe health and working practices at all times.**

#### **1. Selection and establishment of plants.**

Selection, characteristics and prescriptive quality of plants suitable for specific effects, location or display: trees, shrubs, climbers, evergreens and herbaceous plants, groundcover, herbaceous borders, woodland gardens, colour effects, seasonal flowering, scent, berries and fruits. Planting techniques for woody plants to include trees, shrubs, climbers, evergreens and ground cover. Preparation of site for hedging and screens and relationship to cultural requirements. Planting and establishment techniques for a range of herbaceous/hardy perennial plants (to include bulbs, corms and tubers). Name 5 plants for each specific location to include: walls and fences, dry soils, damp soils, acid/alkaline soils, different aspects, shade, screening, coastal and exposed areas.

#### **2. Selection and maintenance of alpine plants.**

Selection, characteristics and prescriptive quality of plants suitable for specific effect or display: rock and alpine gardens, alpine meadows. Annual programme of work to include renovation, top dressing, planting, winter protection, pest, disease and weed control.

**3. Selection and maintenance of aquatic and marginal plants.**

Selection, characteristics and prescriptive quality of aquatic and marginal plants. Maintenance of the garden pool, water, plants and associated features.

**4. Selection and establishment of plants for seasonal display.**

Selection, characteristics and prescriptive quality of bedding plants for colour and seasonal effect. Annual/seasonal bedding schemes and their uses in the garden. Work schedule for 12 month period for seasonal bedding schemes. Maintenance to include sowing and thinning, planting, dead-heading, irrigation, feeding, pest, disease and weed control, support. Half hardy and hardy annuals, biennials and tender perennials. Hanging baskets and containers. Bulbs, corms, rhizomes and tubers.

**5. Maintenance of hardy herbaceous plants and their environment.**

Annual maintenance of herbaceous perennials to include mulching, weed, pest and disease control, pruning, feeding, irrigation, lifting and dividing, and support. Relationship between cultural activities and horticultural principles.

**6. Maintenance of woody plants and their environment.**

Pruning systems and timings for a range of young and established woody plants to include ornamental trees and conifers, climbers, shrubs, hedging and screens, roses and ground cover. Renovation pruning and pruning equipment. Mulching, feeding, irrigation, weed, pest and disease control, support. Relationship between cultural activities and horticultural principles.

**7. Risk assessment**

Risk assessment of landscape maintenance practices. Identification of appropriate safe working practices, safety clothing and equipment.

# Plant Selection, Establishment and Maintenance

Unit level: Advanced Certificate or Diploma

Unit value: 1

Learning outcomes:	Assessment criteria:
1. Describe the selection and establishment of a range of plants.	1.1 Select and evaluate woody plants for a range of purposes and situations.
	1.2 Evaluate planting and establishment techniques for a range of woody plants.
	1.3 Relate the site preparation for a hedge to its cultural requirements.
	1.4 Describe 2 alternative planting and establishment techniques for hedges and screens.
	1.5 Select and evaluate herbaceous/hardy perennial plants for a range of purposes and situations.
	1.6 Evaluate planting and establishment techniques for a range of herbaceous/hardy perennial plants.
2. Describe the cultivation of alpine plants.	2.1 Select and evaluate alpine plants for a range of purposes and situations.
	2.2 Programme and describe the seasonal maintenance for a rock garden and scree bed.
3. Describe the cultivation of plants in a water features.	3.1 Select and evaluate aquatic plants for a range of purposes and situations.
	3.2 Relate the maintenance problems of a garden pool to the plant/animal balance.
	3.3 Plan a maintenance programme for a water feature.
4. Describe the cultural requirements of plants for seasonal display.	4.1 Select and evaluate seasonal bedding plants for a range of purposes and situations.
	4.2 Distinguish between hardy and half hardy bedding plants.

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|----|-----|---|
|    | 4.3 | Define the terms dot plant, filler and carpet bedding.  |
|    | 4.4 | Produce a work schedule covering the period of a year for a seasonal bedding scheme.  |
|    | 4.5 | Programme and describe the routine maintenance of hanging baskets and containers for both summer and winter effects.                    |
| 5. |     | Describe the maintenance of herbaceous plants.  |
|    | 5.1 | Plan the annual programme of maintenance for an identified area of herbaceous plants.   |
|    | 5.2 | Relate the programme to the cultural requirements of herbaceous plants.   |
|    | 5.3 | Review a range of herbaceous plant support materials and devices.   |
| 6. |     | Relate the maintenance of woody plants to their mode of growth and/or their season of flowering.  |
|    | 6.1 | Describe the maintenance of a range of young and established woody species of ornamental plants including hedges and screens.           |
|    | 6.2 | Relate the pruning systems used with young and established woody ornamental species to their growth patterns and season(s) of interest. |
|    | 6.3 | Review the alternative methods of pruning to renovate old or overgrown woody species.   |
|    | 6.4 | Evaluate the range of pruning equipment available.  |
| 7. |     | Undertake risk assessments.   |
|    | 7.1 | Determine the elements of risk in the practical operations associated with this unit.   |
|    | 7.2 | Identify the safe working practices for the operations identified, to include personal protective equipment and clothing.               |

## Module J (Option)

**Unit Title: Hardy Ornamental Nursery Stock**

**Unit Code: Diploma T/103/6018                      Advanced Y/103/5816**

**Unit Value: 1**

**Unit Level: Advanced Certificate or Diploma**

### Description of Unit

This unit requires students to build upon aspects of the horticulture and science core to provide a broad overview of the practices and processes involved in the successful propagation and production of hardy nursery stock. It will enable students to have a clear understanding of the use of protection and of seasonal requirements for specific tasks together with a practical knowledge of plant husbandry techniques.

### Summary of Outcomes

1. Choice of site and equipment for hardy nursery stock production.
2. The production of liners from seed.
3. The production of liners from vegetative material.
4. The production of hardy nursery stock in the field.
5. The production of hardy nursery stock in containers.
6. Risk assessment.

### Content

#### Identifying safe health and working practices at all times.

#### 1. Choice of site and equipment for hardy nursery stock production.

Aspect, slope, shelter, soil, drainage, availability of water for irrigation, services, access to site and to markets. Greenhouses, plastics clad tunnels, double clad fogging tunnels, netting clad tunnels, frames, polythene cloches, fleece, bell-jars, closed cases, contact polythene, mist propagation, micro-propagation and shelter both artificial and natural.

#### 2. The production of liners from seed.

The production of liners for **one of each** of the following: a hedging plant, a native tree species, *Rosa canina* for use as a rootstock and a named conifer.

Seed; provenance, availability (seasonal variation), storage, treatments to overcome dormancy, pre-sowing treatment, the calculation of germination rates. Seedbed preparation; weed treatment, soil amelioration, soil sterilization, fertilizer requirements, seedbed dimensions, seedbed formation and sowing timetable. Seedbed management; sowing and covering seed, irrigation, pest, disease and weed control, lifting and grading prior to lining out.

Small-scale production using containers; seed sowing methods, covering, watering requirements, protection from pests and from the weather.



### **3. The production of liners by vegetative means.**

Stock plant management: choice of stock plants, siting, planting and maintenance, availability of propagation material. Types of cutting, propagation method(s), propagation timetable, management and maintenance of the propagation area, lifting and grading the cuttings prior to containerizing or lining out in the field. Stool beds, layer beds and hedgerows; the production cycle and maintenance.

### **4. The field production of hardy nursery stock.**

The production of bush roses and **one of each** of the following: conifers, shrubs, herbaceous plants, native trees on their own roots and trees budded or grafted onto a named rootstock. Preparation of the site; soil preparation, orientation of rows, setting out the rows, planting method including firming in, labelling and recording. Source of planting material; produced on site, bought in from specialist producers, virus tested stock. Quality; B.S. specifications, buyer's specifications, Plant Breeders' Rights. Crop management; planting by both hand and machine, overall production timetable, routine management of the crop including cultivations, supporting and tying in, trimming and pruning, pest, disease and weed control and irrigation. Budding and grafting in the field. Lifting field grown stock; undercutting prior to lifting, stage of plant development, field conditions, hand and mechanical methods, the treatment of bare root and root balled plants, grading, storage, labelling and packaging.

### **5. The container production of hardy nursery stock plants.**

The production of **one of each** of the following: deciduous shrubs, evergreen shrubs, conifers, herbaceous plants, alpines and heathers. Growing-on area; siting, drainage, weather protection, irrigation, production system. Containerizing area (potting shed); preparation of plant material prior to potting, choice of compost and containers, work stations, potting procedure, efficient layout of the work area. Handling containerized plants; mechanization systems, setting out the plants, spacings and watering in. Management of container grown plants; watering, fertilizer applications, staking and tying, pruning and trimming, pest, disease and weed control. Preparing container grown stock for marketing; market specifications, selection and transport system, cleaning and labelling.

### **6. Risk assessment.**

Risk assessment of hardy nursery stock production. Identification of appropriate safe working practices and selection of appropriate safety clothing and equipment. Meet statutory requirements for irrigation run off.

# Unit Title: Hardy Ornamental Nursery Stock

Unit level: Advanced Certificate or Diploma

Unit value: 1

Learning outcomes:	Assessment criteria:
1. Identify the site requirements and equipment needed for the production of hardy nursery stock.	1.1 Describe the requirements of a site to be used for hardy nursery stock production.
	1.2 Evaluate the range of propagation equipment.
	1.3 Evaluate a range of soils for the field production of HONS.
	1.4 Relate irrigation needs to the crop, weather and soil conditions.
2. Describe the production of liners from seed.	2.1 Explain the importance of seed quality.
	2.2 Relate the storage and pre-sowing treatments for a range of seeds for the underlying horticultural principles.
	2.3 Calculate the seed sowing rate for a range of circumstances.
	2.4 Explain the requirements of outdoor seedbeds.
	2.5 Prepare a propagation timetable for a range of liners.
	2.6 Evaluate a range of methods available for sowing seed in prepared seedbeds.
	2.7 Prepare a plan for the management of outdoor seedbeds.
	2.8 Explain the processes for the lifting and grading seedlings in preparation for lining out.
3. Describe the production of liners from vegetative material.	3.1 Explain the importance of quality and source of vegetative material.
	3.2 Explain the requirements of a stock bed.

- 3.3 Prepare a yearly management plan for an area of stock beds and stock hedgerows.
- 3.4 Relate the preparation, treatment, insertion and aftercare of a range of cuttings to the underlying horticultural principles.
- 3.5 Describe the efficient collection and storage of vegetative material.
- 3.6 Evaluate a range of methods by which the propagation material can be extended.
- 3.7 Explain the processes involved in the lifting and grading of cuttings in preparation for lining out or containerising.
- 4. Describe the production of hardy nursery stock in the field.
  - 4.1 Explain the processes involved in the preparation and maintenance of a site.
  - 4.2 Explain the importance of liner quality.
  - 4.3 Compare and contrast planting of liners by hand and machine.
  - 4.4 Compare and contrast the lifting of HONS by hand mechanical methods.
  - 4.5 List the grading requirements of HONS.
  - 4.6 Describe the production, harvesting and transportation of a range of HONS.
- 5. Describe the production of hardy nursery stock in containers.
  - 5.1 Explain the conditions required for growing on a range of containerised stock.
  - 5.2 Evaluate the range of compost ingredients and containers available for hardy nursery stock.
  - 5.3 Evaluate appropriate systems for containerising, handling and transporting stock within the nursery.
  - 5.4 Prepare a management plan for the maintenance of nursery stock on a standing out area.

- 6. Undertake risk assessment.
  - 6.1 Determine the elements of risk in all of the practical operations associated with this unit.
  - 6.2 Identify the safe working practices for all the operations identified, to include personal protective equipment and clothing.

Withdrawn Qualification