Higher National Unit specification

General information for centres

Unit title: Horticultural Growing Media

Unit code: F2B0 35

Unit purpose: This Unit is designed to provide candidates with an understanding of the design and management of soilless growing media used in the cultivation of horticultural plants and crops. The emphasis is on the study of soilless cultivation systems and growing media as an environment for plant growth.

On completion of the Unit the candidate should be able to:

1 Describe the essential characteristics of appropriate soilless growing techniques.
2 Devise suitable soilless growing techniques for particular plants and cultural situations.
3 Describe the management of soilless growing techniques.

Credit points and level: 1 HN credit at SCQF level 8: (8 SCQF credit points at SCQF level 8*)

**SCQF credit points are used to allocate credit to qualifications in the Scottish Credit and Qualifications Framework (SCQF). Each qualification in the Framework is allocated a number of SCQF credit points at an SCQF level. There are 12 SCQF levels, ranging from Access 1 to Doctorates.*

Recommended prior knowledge and skills: Access to this Unit is at the discretion of the delivering centre, however, it would be beneficial for candidates to have studied biology or other relevant science subjects preferably to Standard Grade level (SCQF level 5) or equivalent. It would also be beneficial but not essential for candidates to have studied aspects of soil science; national Units that are relevant would include the Units:

- F21V 34 *Soil Management*
- F1JL 35 *Soils and Crop Nutrition*

Core Skills: There are opportunities to develop the Core Skill of *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Context for delivery: If this Unit is delivered as part of a Group Award, it is recommended that it should be taught and assessed within the subject area of the Group Award to which it contributes.

Assessment: Assessment can reflect the teaching approach taken by a particular centre and the particular interest within the horticultural and landscape sector of the candidates. It is recommended that three Outcomes could be combined in one instrument of assessment which would require candidates to provide a report on two case studies reflecting contrasting cultural situations/crops appropriate to their interests within the field of horticulture and landscape management.

Higher National Unit specification: statement of standards

Unit title: Horticultural Growing Media

Unit code: F2B0 35

The sections of the Unit stating the Outcomes, Knowledge and/or Skills, and Evidence Requirements are mandatory.

Where evidence for Outcomes is assessed on a sample basis, the whole of the content listed in the Knowledge and/or Skills section must be taught and available for assessment. Candidates should not know in advance the items on which they will be assessed and different items should be sampled on each assessment occasion.

Outcome 1

Describe the essential characteristics of appropriate soilless growing techniques

Knowledge and/or Skills

- The provision of essential plant growth requirements by soilless cultivation techniques
- Nature and properties of bulk substrates
- Forms, sources and availability of essential plant nutrients
- Control of pH and salinity
- The provision of water and air to roots and the manipulation of substrate physical properties
- Principles of hydroponic growing systems including nutrient film technique and substrate-based techniques
- Formulation of hydroponic feeds
- Formulation of media for pot/container-grown plants

Evidence Requirements

See Evidence Requirements for the Unit at the end of the statement of standards.

Assessment Guidelines

It is intended that the assessment of this Outcome should be combined with that for Outcomes 2 and 3.

Outcome 2

Devise suitable soilless growing techniques for particular plants and cultural situations

Knowledge and/or Skills

- How to take account of the conditions in the cultural environment for both indoor and outdoor crops
- How to take account of the growth requirements of plants
- The practical needs of the cultural systems, including cost, ease of handling, uniformity, reliability of supply, ease of management, etc of growing media and their ingredients
- Matching the design of the cultivation system and/or growing media to the above conditions, requirements and needs

Higher National Unit specification: statement of standards (cont)

Unit title: Horticultural Growing Media

Evidence Requirements

See Evidence Requirements for the Unit at the end of the statement of standards.

Assessment Guidelines

It is intended that the assessment of this Outcome should be combined with that for Outcomes 1 and 3.

Outcome 3

Describe the management of soilless growing techniques

Knowledge and/or Skills

- Monitoring and analysis for nutritional status, pH and salinity
- Selection and application of post-planting fertilisers and liquid feeds
- Watering and irrigation
- Drainage systems
- Recognition of common nutritional and physiological disorders and their treatment or prevention

Evidence Requirements

See Evidence Requirements for the Unit at the end of the statement of standards.

Assessment Guidelines

It is intended that the assessment of this Outcome should be combined with Outcomes 1 and 2.

Evidence Requirements for the Unit

This Unit is intended to be assessed by a single instrument of assessment which would require candidates to produce a report or reports and answer questions based on two case studies. The two case studies should be selected for the candidate and should be appropriate to their horticultural interests. Case studies could be based on real-life situations that have been experienced by the candidate either during their studies or during work experience. Alternatively, case studies could be based on hypothetical situations devised by the assessor.

Where all candidates in a class have unique case studies then assessment could be carried out in non-controlled conditions in the candidate's own time.

Where groups of candidates in a class have the same case studies then assessment should be carried out in controlled conditions, and if taking place as a single event it is suggested that this should last no more than two hours. Candidates should be given the details of the case studies in advance of the assessment event (about 7–14 days). They may bring to the event a copy of the case study and notes that they have prepared personally. They may not bring textbooks, handouts, product literature or other material not prepared by themselves. The notes should be handed-in at the end of the assessment.

Higher National Unit specification: statement of standards (cont)

Unit title: Horticultural Growing Media

Examples of appropriate case study topics are given in the support notes. For each case study the candidate should be required to:

- accurately assess, and where appropriate quantify, the key requirements of the plant/crop in terms of demand for essential growth requirements and tolerances of environmental and biological stresses
- accurately assess, and where appropriate quantify, the key environmental conditions which will impact on the growth of the plant/crop and which will influence the selection and management of the most suitable cultivation system and/or growing media
- evaluate and select an appropriate soilless growing technique and/or growing media for the plant crop in the given environmental conditions and provide reasoned justification for the selection
- accurately describe the essential characteristics of any bulk substrates to be used (these might include texture, density, ease of handling, stability, porosity, nutrient content, etc)
- describe the characteristics and quantities of other ingredients to be added to the bulk substrates (these might include fertilisers, limes, wetting agents, pesticides, etc)
- describe the management regime for the plants/crops that would have to be employed for successful cultivation in terms of provision of nutrients, water, drainage, control of pH and salinity, etc

Administrative Information

Unit code: F2B0 35

Unit title: Horticultural Growing Media

Superclass category: SA

Original date of publication: August 2007

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History of changes:

Version	Description of change	Date

Source: SQA

SQA acknowledges the valuable contribution that Scotland's colleges have made to the development of Higher National qualifications.

Additional copies of this Unit specification can be purchased from the Scottish Qualifications Authority. Please contact the Customer Contact Centre for further details, telephone 0845 279 1000.

Higher National Unit specification: support notes

Unit title: Horticultural Growing Media

This part of the Unit specification is offered as guidance. The support notes are not mandatory.

While the exact time allocated to this Unit is at the discretion of the centre, the notional design length is 40 hours.

Guidance on the content and context for this Unit

The Unit deals with the practical issues relating to the selection, use and management of soilless growing techniques and growing media, fertilisers, irrigation, etc. Consideration is given to hydroponics, potting mixes and other container growing media. Use in both outdoor and protected situations, and for a wide range of cultivated plants is considered.

Horticultural soilless growing techniques and growing media have been developed to overcome the deficiencies of soil-based cultivation and are used to optimise the growing conditions for plants/crops and, in the case of commercial crops, to maximise productivity. It is therefore important that soilless growing techniques are carefully selected to match the requirements of the crop and the growing environment. This Unit aims to provide candidates with an understanding of the more common soilless growing media and techniques that are utilised in horticulture. At the end of the Unit the candidate will be able to select and describe appropriate techniques and growing media for given plants/crops and cultural environments.

Most candidates taking this Unit as part of a Group Award, typically in Horticulture, should already have studied soils and their management and will be familiar with many of the concepts and scientific principles which underpin this Unit. Examples would be; essential micro and macro plant nutrients, pH, available water, waterlogging, drought, cation exchange and buffering, decomposition of organic matter, mineralisation of organic nitrogen, field capacity, drainage and aeration. Candidates taking this Unit in isolation would require additional tuition to develop adequate understanding of such concepts and principles and this would probably require time in addition to the nominal design length stated above.

The aim should be to avoid candidates following a simple recipe approach to the selection and formulation of growing techniques and media; rather candidates should be able to tailor them to the each individual crop and growing environment.

In learning Outcome 1 candidates should begin by considering all the essential growth requirements of plants and particularly those acquired or required by the root system including; water, oxygen, micro and macronutrients, heat and support. It is essential to stress the need to ensure that all requirements are considered and provided in the design of soilless growing techniques. This concept might most readily be illustrated by consideration of hydroponic nutrient film technique which in principal provides the simplest model growing system.

Consideration of rooting substrates could begin with simple inert substrates for hydroponic growing including rockwool and perlite. Then introducing more ‘complex’ substrates such as peat, coir and composted bark with buffering capacities, nutrient contents and degradable organic mater, as pot and container growing media are considered. Substrates characteristics to be described could include; density and porosity, water-holding, capacity, air-filled porosity, physical stability, cohesiveness, pH, buffering capacity, salinity, presence of toxins, risk of weeds, pests or diseases, potential for nitrogen immobilisation or mineralisation, handling characteristics, reliability of supply and quality, cost.

Consideration of sources and availability of essential plant nutrients must first of all consider the balance between those included in the growing media and those applied post establishment as liquid feeds. The relative merits of fertiliser types including soluble inorganic, slow release, controlled release and organic should be considered. The impact of fertiliser and feed application on the pH and salinity of the growing media or hydroponic solution should be understood.

The importance of substrate porosity and in particular the balance between water-filled and air filled porosity should be understood. Manipulation of substrate porosity by grading the texture of substrate or by the mixing of substrates and openers should be demonstrated and could be included as a practical exercise allowing candidates an opportunity to handle and experience a range of common substrates.

Candidates should be introduced to typical growing media and techniques as employed for the more common plants and crops eg tomatoes in nutrient film technique, cucumbers grown hydroponically using rockwool as a substrate, ericaceous hardy ornamental nursery stock grown in peat, bedding plants, flowering pot plants.

In learning Outcome 2 candidates should consider the cultural environment including; indoor or outdoor, drainage systems and type of standing beds (eg use of sand beds or gravel standing), quality of water supply (hardness, nutrient content, etc), type of watering regime or irrigation system (overhead, ebb and flow, capillary, etc), climate (including humidity, rainfall and temperature). The impact that these factors have on the choice and management of the growing system should be understood.

Consideration of plant/crop requirements would include knowledge of, nutrient requirements, (eg contrasting vegetative growth and flowering/fruiting crops), sensitivity to pH, salinity and waterlogging, duration of crop, container size, etc. Understanding of the uses and properties of a range of container types should be taught (including plugs, modules, pots — large and small, liners, grow-bags, planters, hanging baskets). A range of typical plant/crop types could be considered including: hardy trees and shrubs, ericaceous hardy shrubs bedding plants, epiphytes, vegetable transplants, cut flowers, edible salads, herbs, foliage and flowering ornamental pot plants.

Practical needs of the cultural system are particularly important in commercial crop production. Cost, ease of use/management, reliability of the technique, reliability of supply of ingredients, environmental impact in terms of both the source of the substrates and the possible waste/pollution impacts, should be considered.

Matching the design of the cultivation system and/or growing media to the above conditions, requirements and needs should result in a blueprint for both the growing techniques/media and for the post planting management (see Outcome 3). Candidates should be able, for example, to calculate quantities of fertiliser additions to growing media and liquid feeds and this could form the basis of a practical problem solving exercise. Selection of substrate should take account of factors including plant type cultural environment, container size, irrigation and drainage systems. Candidates should be able to justify the selections they make.

Higher National Unit specification: support notes (cont)

Unit title: Horticultural Growing Media

In learning Outcome 3 candidates should be able to describe post-establishment management of the supply of essential growth factors via the plant root system — particularly water, oxygen and nutrients. They should be aware of the need for monitoring, including sampling and analysis, of nutritional status, pH and salinity, and how to act on the results of such monitoring in terms of adjustments to the watering and feeding regime. Accordingly they should be able to describe appropriate rate and frequency. They should also be familiar with appropriate watering and irrigation regimes. A basic familiarity with the nature and occurrence of common nutritional and physiological disorders and their treatment or prevention should be developed. These might include the more commonly experienced nutritional deficiencies such as nitrogen, iron, boron, calcium, magnesium and related physiological disorder such as blossom end rot and tip-burn.

Guidance on the delivery and assessment of this Unit

Opportunities should be included for practical sessions, eg in the calculation and formulation of fertiliser additions to growing media, or in the formulation of feeds or hydroponic solutions. Hands on practical experience of handling substrates and mixing growing media and feeds. Visits to nurseries, growers and manufacturers should ideally be included and could, within a Group Award be shared with complimentary Units such as F1JJ 35 *Protected Crops*, F2AY 35 *Hardy Ornamental Nursery Stock: Container Production*, F1JF 34 *Nursery Production.*

Examples of case studies which might be appropriate to form the basis of the assessment instruments might be:

- production of heathers (eg Calluna vulgaris) from cuttings in 1 litre pots stood on sand drainage beds in polythene tunnels
- production outdoors on gravel standing areas beds of standard native deciduous trees (eg Betula pendula) in 10 litre pots
- production of cut chrysanthemum in a heated glasshouse using substrate-based hydroponic growing techniques
- production of modular brassica transplants in a heated glasshouse in spring for subsequent field planting
- production of modular brassica transplant in a heated glasshouse for the Christmas market
- production of sweet peppers in a heated glasshouse using nutrient film techniques hydroponic cultivation

The following texts or current equivalents are appropriate for the Unit:

- Bunt, A C (1988), '*Media and Mixes for Container-grown Plants*', Unwin Hyman
- Bragg, N (1995), '*Growing Media*', '*Growing Handbook 1'*, Grower Books, Nexus Media Ltd, Kent
- Handreck, KA and Black, ND (1999), '*Growing Media for Ornamental Plants and Turf*' New South Wales University Press, Sydney
- MAFF (2000), '*Fertiliser Recommendations for Agricultural and Horticultural Crops*' (RB209) 7th edition (formerly Reference Book 209) Stationary Office, London

Higher National Unit specification: support notes (cont)

Unit title: Horticultural Growing Media

Opportunities for developing Core Skills

There are opportunities to develop the Core Skill of *Problem Solving* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skills components.

Open learning

Elements of this Unit could be delivered by distance or flexible learning. It is probable that candidates would need to attend the centre for assessment of Outcomes 1–3, though this could be done in other locations under approved supervision.

Candidates with disabilities and/or additional support needs

The additional support needs of individual candidates should be taken into account when planning learning experiences, selecting assessment instruments, or considering alternative Outcomes for Units. Further advice can be found in the SQA document *Guidance on Assessment Arrangements for Candidates with Disabilities and/or Additional Support Needs* **(www.sqa.org.uk)**.

General information for candidates

Unit title: Horticultural Growing Media

This Unit is designed to provide you with an understanding of the design and management of soilless growing media which are used in the cultivation of horticultural plants and crops. The Unit deals with the practical issues relating to the selection, use and management of soilless growing techniques and growing media, fertilisers, irrigation, etc. It provides essential underpinning knowledge and develops skills which will be invaluable both to those who go on to work in practical horticulture from the garden to large nursery or production Unit. Equally, it provides an essential ground for those continuing to higher levels of study who might for example, become involved in research and development work.

During the course of the Unit you will learn about hydroponic cultivation, potting mixes and other container growing media. Their use in both outdoor and protected situations (glasshouses and poly-tunnels), and for a wide range of both edible and ornamental cultivated plants will be considered. By the end of the Unit you should be able to devise suitable growing techniques for specific plants and cultural situations and will learn how to match this to the conditions in the cultural environment, the growth requirements of plants and the practical needs of the cultural system. You will gain familiarity with the formulation, use and management of substrates, growing media, fertilisers, liquid feeds, hydroponic solutions.

This Unit will be assessed by a single instrument of assessment where you will have to produce an extended report based on two case studies which will in part require some personal research. The two case studies will be chosen so as to be appropriate to your horticultural interest and might be based on real-life situations that you have experienced during practical sessions or work experience. You will be asked to evaluate and select an appropriate soilless growing technique and/or growing media for the plant/crop in given environmental conditions and provide reasoned justification for the selection.