

Higher National Unit specification

General information for centres

Unit title: Horticultural Mechanisation Principles

Unit code: F21P 34

Unit purpose: This Unit is designed to introduce candidates to the fundamentals of horticultural mechanisation. Through an understanding of the principles of the production and use of power in horticulture, and the associated maintenance needs, machines that are suitable and appropriate for all types of horticultural businesses can be identified. The Unit uses horticultural vehicles and the equipment for cultivation and grass-care as examples of the application of the principles, and hence the Unit improves awareness of these important horticultural machines and expands important aspects of health and safety

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

- 1 Describe the sources of power used in horticulture.
- 2 Explain the use of power within vehicles and equipment in horticulture.
- 3 Prepare schemes for the care and maintenance of horticultural vehicles and equipment.
- 4 Select a vehicle or pedestrian operated machine for a given horticultural application.

Credit points and level: 1 HN credit at SCQF level 7: (8 SCQF credit points at SCQF level 7*)

**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 is recommended that candidates possess basic mathematical skills equivalent to Standard Grade and have some experience of operating powered horticultural equipment.

Core Skills: There are opportunities to develop the Core Skills of Numeracy, Problem Solving and Communication 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: This Unit has assessments associated with each of the four Outcomes. Outcome 1 is assessed by means structured assignment or workbook, Outcome 2 is assessed by a short written test and a written report, Outcome 3 by completion of a logbook and Outcome 4 a short selection exercise. Except for the written test the assessments should examine understanding rather than recall.

Higher National Unit specification: statement of standards

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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 sources of power used in horticulture

Knowledge and/or Skills

- ◆ Layout and principles of operation of small internal combustion engines
- ◆ Lubricants and engine lubrication systems
- ◆ Engine cooling systems
- ◆ Fuels and engine fuel and ignition systems
- ◆ Mains electrical systems and electrical safety

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ describe the mode of operation of small two and four stroke engines to the extent required to inform the selection, safe operation and maintenance of horticultural equipment
- ◆ describe the applications for alternative engine lubrication and cooling systems
- ◆ explain the choice of lubricants relative to operating conditions
- ◆ describe the principal operator adjustments that influence the operational performance of engines
- ◆ describe the features of a simple mains electrical system that promotes safety of the equipment and operator
- ◆ determine the correct fuse value required for use in the plug of a simple mains operated piece of equipment
- ◆ determine the cost of operating electrical equipment using tariff information

Assessment Guidelines

Outcome 1 is assessed by a structured assignment. This should consist of a mix of styles of exercises to cover the Evidence Requirements that are completed by the student under open-book conditions. The assessment might consist of mix of instruments for example: multiple choice, filling in the blanks, calculation, short answer, restricted response and other written material. The assessment should be related to the crop interest of the individual student and should be conducted under open-book conditions.

Higher National Unit specification: statement of standards (cont)

Unit title: Horticultural Mechanisation Principles

Outcome 2

Explain the use of power within vehicles and equipment in horticulture

Knowledge and/or Skills

- ◆ Vehicle systems including transmissions and equipment attachment
- ◆ Control and stability of vehicles
- ◆ Soil cultivation principles and equipment
- ◆ Grass care equipment

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ explain the principles of operation and the relative advantages and disadvantages of common power supply systems for horticultural vehicles and equipment appropriate to the needs of a manager
- ◆ correctly explain the factors that influence the stability and safe operation of vehicles and equipment
- ◆ identify the aims and objectives of soil cultivation and explain the extent to which these are met by powered and non-powered cultivators with reference to their mode of operation
- ◆ explain the principles of operation and layout of shear and inertial mowing machines, the function of the operational adjustments and their suitability for different applications to the standard expected of a manager

Assessment Guidelines

It is recommended that Outcome 2 is assessed by two assessment instruments. The first, which assesses the first two Evidence Requirement elements, is a closed-book written test with a few short answer questions. The test is needed as the evidence should be available from recall. The second assessment instrument consists of a report on the areas of cultivation and grass care machinery presented either in a written format or as an oral presentation. As a structured written report it should extend to about 1,000 words plus supporting (diagrammatic and tabular) information undertaken under open-book conditions. As an oral presentation it should be of the same extent as a written report and presented to other class members and encompass visual material.

Outcome 3

Prepare schemes for the care and maintenance of horticultural vehicles and equipment

Knowledge and/or Skills

- ◆ Materials use in machines and their deterioration
- ◆ Options for maintenance, repair and overhaul
- ◆ Tool and equipment needs for maintenance
- ◆ Statutory literature and decal interpretation

Higher National Unit specification: statement of standards (cont)

Unit title: Horticultural Mechanisation Principles

- ◆ Spares, consumables and stock management
- ◆ Health and Safety issues of machine use

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ correctly recognise common materials used in machinery and state the means by which they deteriorate and outline the factors that influence the rate of deterioration
- ◆ prepare a maintenance checklist appropriate for use by the operator of a vehicle or piece of equipment that details the daily checks to be made that correctly considers the relevant safety issues
- ◆ using manufacturers handbooks, prepare complete lists of: tool and equipment requirements, spares and consumables for a given maintenance interval of a simple machine
- ◆ prepare a pro forma that enables clear machinery records to be kept appropriate to the needs of a machinery manager
- ◆ correctly describe the safe procedure for refuelling a piece of pedestrian operated equipment

Assessment Guidelines

It is recommended that candidates be assessed by means of written exercises in a logbook completed as part of a practical exercise. There should be one exercise for each Evidence Requirement identified.

Outcome 4

Select a vehicle or pedestrian operated machine for a given horticultural application

Knowledge and/or Skills

- ◆ Vehicle and equipment types and options
- ◆ Technical capability and specifications
- ◆ Fitness for purpose and quality
- ◆ Financial considerations of machine use
- ◆ Health and Safety issues

Evidence Requirements

Candidates will need to provide evidence to demonstrate their Knowledge and/or Skills by showing that they can:

- ◆ justify the selection of a vehicle or machine that is suitable in terms of the intended use, projected performance, service requirements, and budgetary constraint
- ◆ state the operator training requirements for the selected machine in accordance with best industry practice

Higher National Unit specification: statement of standards (cont)

Unit title: Horticultural Mechanisation Principles

Assessment Guidelines

It is recommended that Outcome 4 is assessed by means of an assignment completed as an open-book exercise, in which the candidate is provided with details of the situation and general function the vehicle or machine is required to perform and from which the candidate infers the desirable features. This information should then be used in the justification of the choice of machine. The operator training requirements should be clearly identified whether or not a Certificate of Competence is a statutory requirement

Administrative Information

Unit code: F21P 34

Unit title: Horticultural Mechanisation Principles

Superclass category: SK

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History of changes:

Version	Description of change	Date

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Higher National Unit specification: support notes

Unit title: Horticultural Mechanisation Principles

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

This Unit follows a logical sequence from understanding the sources of power through how that power may be used and applied, then looking at how the efficiency of the overall machine and its power components may be maintained through good care and finally considering the selection of a machine through a knowledge of its construction and power systems, how they perform, and their maintenance requirements.

Outcome 1 considers the two most important power sources used in horticulture; engines and electrical power. The aim in relation to both is to identify the most significant features for the user so that their use of power is both safe and efficient. The section on engines considers the options available and how they influence performance and hence their application to an engine driven vehicle or machine. The attributes of: 2 and 4 stroke engines, air or water cooling, splash pump of oil mix lubrication, spark or compression ignition are all considered and the consequences for the operator and for machine care should be highlighted. In considering electricity the most important aspects are its safe use and its cost. Hence understanding the principles of system and equipment integrity, insulation, overload protection, residual current devices, and earthing, the regulatory regime and an appreciation of the key terms (voltage, current, power and frequency) are essential for operator protection. The ability to calculate cost is an essential management skill and this is also included in this Outcome.

Outcome 2 considers how power can be manipulated to achieve one or more objectives. It starts by considering the range of transmission systems available and their operational characteristics. This includes drive systems such as belt, chain, gear and shaft drives, and their overload protection devices, as well as hydraulic systems and hydrostatic transmissions. It is important to stress the characteristics of these systems to relevant horticultural applications particularly as they affect the operator and machine maintenance. Horticultural equipment does not just operate on level ground and for many wheeled or tracked machines their stability is a key issue. Understanding the factors that influence vehicle stability and control is vital to safe operation and is included in this Outcome. The safe application of power is explored through application to two contrasting operations, cultivation and grass cutting. In each case the key issues to be explored are the ability to achieve all the objectives for the machine, and to identify the key aspects for the operator to enable safe use and good care.

Outcome 3 considers machine maintenance. However, most of the issues of importance to the operator will have been considered in relation to Outcomes 1 and 2. Hence this Outcome is concerned with ensuring the managerial aspects of maintenance are in place. This is details of scheduling, control of parts, spares and consumables and effective record keeping. This requires a good knowledge of machine operation but it also requires an ability to understand and interpret manufacturers instructions. Hence it is essential to expose candidates to real 'literature' where it is necessary to comprehend diagrams, symbols, decals as well as written instructions.

Higher National Unit specification: support notes (cont)

Unit title: Horticultural Mechanisation Principles

Finally armed with the above candidates should be able to select a vehicle or a piece of powered equipment for a specific purpose. This is tested in the final Outcome which also considers the (legal) requirements to provide training.

Guidance on the delivery and assessment of this Unit

The Unit is best studied as part of a Group Award in the horticulture. The focus of the Unit is primarily on engine driven horticultural equipment and consequently easy access to equipment to observe points of discussion is highly advantageous. It is also highly beneficial if there is ready access to the main components that comprise machines and their systems. Hence a selection of engine, transmission, cultivator and grass cutter parts would be advantageous.

It is recommended that a mix of classroom, study and practical exercises are used during which the candidates explore a topic by a mix of observation, library study, and lecture material and completes workbooks or logbooks of activities. These may then be used as part of the assessment process, thus reducing the assessment burden and enabling candidates' progress to be easily and accurately monitored.

As much horticultural management is based around effective computer use it is suggested that the checklists and pro forma required for Outcome 3 are submitted as a multipage spreadsheet, or similar PC formatted document, that is submitted online for assessment. If appropriate this could be rolled up with assessments in IT.

It is considered essential that the work programme for candidates follows the order of the Outcomes in order to create a coherent and logical progression of ideas and information.

Opportunities for developing Core Skills

There may be opportunities to gather evidence towards the Core Skills of Numeracy, Problem Solving and Communication at SCQF level 6, however there is no automatic certification of Core Skills or Core Skills components.

Open learning

It is possible for this Unit to be offered by means of distance learning. In terms of the assessments, it may be necessary to make provision for secure assessment for the written test. Access to common horticultural machines for inspection will enable a better, more focussed learning experience.

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 Mechanisation Principles

Horticulture is a highly skilled profession that relies on three key areas of expertise, knowledge of plantsmanship ornamental plants and habitats, the manipulation of growing media and environments and, finally, the safe and efficient use of machines and equipment. This Unit is focussed on the last of these, and considers the essentials of how machines work, the factors that influence their performance, and the managerial responsibilities that go with operating machines.

All machines need a source of energy and for much horticultural equipment this will be either derived from engines or from electricity. Hence the first Outcome explores the principles of engines the types that are available, the features they possess and their operating characteristics. It also looks at the fundamentals of electrical energy supply and focuses on the safety of the use of this potentially dangerous power source in the horticultural environment. This is followed by the second Outcome that looks at how the power produced by engines or electrical motors is used, how it is transmitted and the factors that determine the efficiency of machines. It looks at the pros and cons of using different types of drive and so it helps you to decide whether a machine is likely to perform the job you want it to do. So for example it considers whether a mechanical gearbox or hydrostatic drive would be best for your self propelled mower. As it is the effectiveness with which the power is used that is important to the grower, the Unit considers how power is used in two common applications: cultivation and mowing.

Poor maintenance leads to unsafe machines and increased operating costs so the third Outcome looks at the managerial responsibilities that go with machine use and in particular the need to maintain equipment. Scheduling, checklists, spares and stock control, and record keeping are key areas that are considered. Finally it is important to be able to select the right machines for the job. So the final Outcome looks at detailing the requirements for the machine and specifying the operator skills requirements as the essential preliminary steps in machine selection.

The complexity of current horticultural machinery is considered in an easy structured manner. The need for energy efficiency and effective health and safety are considered in context and stressed throughout the delivery and assessment of the Unit.