Higher National Unit specification

General information for centres

Unit title: Soil Management

Unit code: F21V 34

Unit purpose:

On completion of the Unit the candidate should be able to apply knowledge of soil properties and processes for the management of plant nutrition and the rooting environment. It is essential in the land-based industries, especially in today's climate of increasing environmental protection, to understand soils in order to manage them effectively. This Unit will develop candidates' skills in assessing soil properties and soil fertility and evaluating the most appropriate management practices.

On completion of the Unit the candidates will be able to:

1 Describe the main properties of soils.
2 Describe methods used to optimise the soil's supply of essential plant requirements.
3 Describe the soil management requirements of a site.

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.

Core Skills: There are opportunities to develop the Core Skills of *Problem Solving*, *Numeracy* and *Communication* at SCQF level 6 in this Unit, although there is no automatic certification of Core Skills or Core Skill 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 will normally be assessed by a combination of short answer, restricted response and extended response questions and a report based on site visits/case studies. The assessments for Outcome 2 and 3 could be combined as a single assessment.

Higher National Unit specification: statement of standards

Unit title: Soil Management

Unit code: F21V 34

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 main properties of soils

Knowledge and/or Skills

- Texture
- Structure
- Soil Water
- Organic matter
- pH
- Stoniness, depth and colour
- Nutrients

Evidence Requirements

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

- describe the main properties of a soil

Where sampling is used, the description of the soil properties should cover a minimum of five from seven of the above Knowledge and/or Skills points. If a re-assessment is required it must be based on a significantly different assessment.

Assessment Guidelines

This Outcome would normally be assessed by short answer, restricted response or extended response questions conducted under closed-book supervised conditions.

Higher National Unit specification: statement of standards (cont)

Unit title: Soil Management

Outcome 2

Describe methods used to optimise the soil's supply of essential plant requirements

Knowledge and/or Skills

- Structure management
- Management of soil water
- Organic matter management
- pH management
- Erosion control
- Nutrient management (including use of organic and inorganic methods)

Evidence Requirements

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

- describe methods to optimise the soils supply of essential plant requirements

Where sampling is used candidates will need to demonstrate that they can accurately describe at least four out of six of the soil requirements listed above. These will be sampled under supervised conditions. In order to ensure that candidates will not be able to foresee what items will be assessed a different sample of Knowledge and/or Skills is required each time the Outcome is assessed.

Assessment Guidelines

Evidence could be generated through a report based on site visits and/or profile descriptions. The assessment for this Outcome could be combined with Outcome 3 as part of a single report based on a case study. Alternatively evidence could be generated through restricted response, short answer or extended response questions conducted under closed-book supervised conditions.

Higher National Unit specification: statement of standards (cont)

Unit title: Soil Management

Outcome 3

Describe the soil management requirements of a site

Knowledge and/or Skills

- Intended future use of site
- Structure management
- Water management
- Organic matter management
- pH management
- Erosion control
- Nutrient management

Evidence Requirements

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

- describe the appropriate soil management requirements of a site

If appropriate, workings should be shown for calculations used to recommend fertiliser and lime rates

Assessment Guidelines

Evidence will normally be generated through a report based on site visits and/or profile descriptions. The assessment for this Outcome could be combined with Outcome 2 as part of a single report based on a case study.

Administrative Information

Unit code: F21V 34

Unit title: Soil Management

Superclass category: SB

Original date of publication: August 2007

Version: 02 (June 2009)

History of changes:

Version	Description of change	Date
02	Superclass category changed from RF to SB.	05/06/09

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: Soil Management

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 will be taught in the context of land uses appropriate to the programme of study within which it is delivered, eg agriculture, forestry, horticulture, etc. It is designed for anybody involved in assessing or managing soils. It is envisaged that the majority of candidates will be those concerned with growing plants for production (eg agriculture and horticulture), for conservation (eg habitat establishment), for reclamation of degraded land (eg amenity horticulture, environmental management), or for horticulturists initiating a change of land use. The Unit should also be of benefit for candidates involved in pollution control (eg with respect to catchment-sensitive farming), waste management (eg the application of non-agricultural waste to land) and climate change (eg carbon sequestration).

The Outcomes progress logically through:

1 Basic knowledge of soil properties to allow candidates, during later Outcomes, to describe these properties in order to identify potential problems/opportunities.
2 Knowledge of general methods available to manipulate soils for optimal effectiveness.
3 Accurate choice of soil management techniques, as outlined in Outcome 2, to optimise the soil in a specific site.

Outcome 1. Many soil properties can be measured easily, eg texture, structure, colour, pH, depth, organic matter content. Others, such as drainage status, water holding capacity, and erosion potential, may require to be determined in other ways.

Outcome 2. The essential requirements that plants obtain from the soil include water, oxygen, anchorage and nutrients. Soils may influence weeds, pests and diseases.

Structure management could involve a variety of techniques including manual and mechanical cultivations. The effect of soil texture, organic matter content and previous management are also important. Cultivations can be used to relieve compaction, prepare seedbeds and incorporate organic matter.

The management of soil water could include methods employed to improve drainage (through drainage systems such as pipes/tiles, mole drains, subsoiling, permeable fill, pump drainage systems, French drains, etc.), to apply water (irrigation systems) or to alter the existing water holding capacity and available water.

Organic matter management involves reducing unnecessary operations that could lead to increased oxidation of organic matter (eg over-cultivation) and increasing the levels of organic matter (eg addition of suitable organic materials such as manures, green wastes, etc).

pH management is increasing or decreasing the pH to suit the end-use of the soil/site. The selection of an appropriate material (eg lime), application rate, application method, the quantity required and cost should be considered.

Erosion control methods include engineering approaches (dams, mulches, terracing), biological approaches (ie using plants and crops to control erosion — wind breaks, cover crops etc) and agronomic approaches (emphasising that good soil management will improve yields and sustain productivity by reducing erosion).

In the management of nutrients, methods employed to increase availability and reduce soil losses (eg through leaching, volatilisation, denitrification), to increase effective rooting (eg by improving structure and drainage), and to increase solubility/availability of nutrients (eg by controlling pH). Candidates should consider organic and inorganic sources of nutrients and could describe for their selection(s) — whether soluble or slow/controlled release, the analysis, application rate, timing of application, method of application, cost could be considered.

Outcome 3. Selection of appropriate practices and techniques requires an understanding of the basic properties of the site and soil under investigation, a clear appreciation of the intended future use of the land and the way in which land characteristics and soil properties may need to be sustained or changed in order to meet the needs of the future use, an appreciation for each management technique of its resource requirements (physical resources, labour requirements, costs, etc), the way in which the technique is implemented or applied, and the impact that the technique has on the land (including any potential detrimental effects on the environment).

Structure management involves cultivations to prepare seedbeds and operations necessary to remove compaction. Also important is the need to *avoid* compaction.

Water management involves removal, application or management of water holding capacity.

Organic matter management involves unnecessary operations that increase oxidation of organic matter and methods available to increase organic matter levels.

pH management requires choosing appropriate materials, calculating application rates, timing and method of application.

Good nutrient management involves fertiliser/organic matter selection, rates of application, timing, and method.

Erosion control includes protecting the soil surface, increasing the infiltration rate and avoiding compaction, reducing the velocity of run-off and wind.

Higher National Unit specification: support notes (cont)

Unit title: Soil Management

Guidance on the delivery and assessment of this Unit

Soils are managed by a great number of diverse groups — agriculturalists, horticulturists, conservationists, environmental managers etc. Soil Management underpins a large number of Units across a range of programmes. Such Units include those involved in production, ecology, waste management and pollution control.

The purpose of soil management is to ensure optimal conditions for plant growth or environmental control. It is important to be able to recognise when soil properties are causing, or will cause, problems. It is important to be able to identify which soil management operations are required to improve conditions and to recommend appropriate management practices for maintaining desirable soil conditions.

The Unit should ideally be delivered through a combination of lectures, practicals and site visits.

Practicals could consist of hand texturing, lab experiments, greenhouse trials and microscope work. Demonstrations could also be set up.

A major part of the Unit is likely to be spent in the field looking at soils. Profiles should be dug and candidates should be given the chance to develop skills in identifying and describing soil properties. Profiles should be described in a methodical way, taking each horizon at a time, and describing the physical characteristics of the soil (texture, structure, organic matter levels, stoniness, colour and depth of each horizon).

At the same time, evidence of soil biota can be observed. These could include animals and their eggs, roots, mycorrhizae and indirect evidence such as faecal pellets, earthworm burrows, gastropod tunnels, or humification or its absence.

pH can be roughly indicated using indicator strips or dyes. Electrical conductivity and redox potential can also be measured in the field.

Once the soil characteristics have been described then the candidates should discuss the qualities of the soil. For instance, rooting potential is affected mainly by soil depth and structure, but other factors will also affect how deep the roots could grow (eg drainage and subsoil pH being the most important). Drainage status could be indicated by colour (eg depth and degree of mottling). Candidates could also identify any problems causing poor drainage (eg compaction or high groundwater table). Droughtiness is affected by a combination of texture, organic matter levels, rooting potential and stoniness. Susceptibility to erosion may be affected by soil properties such as texture, organic matter levels, drainage, and structure (as well as land features such as slope, vegetation cover and exposure to wind). Ease of cultivation involves: intensity of cultivations required to produce a seedbed; power requirement; and number of working days (ie ease of access). Susceptibility to capping depends mainly on soil texture, tilth and organic matter levels.

Results of soil analysis (P, K and Mg) could also be discussed on site. An assessment of nitrogen status (based on site history and presence/absence of legumes, and also site properties such as drainage status) could also be made.

Higher National Unit specification: support notes (cont)

Unit title: Soil Management

Health and safety should be emphasised throughout.

Wherever possible, opportunities should be taken to relate soil management to the subject are of the candidates concerned.

So far as assessment goes, it is likely that the digging of a soil profile pit (or pits) will be a group effort. The report, however, must be the work of each candidate.

The closed-book test(s) should allow candidates to demonstrate a good level of understanding of soils and, if appropriate, relevant management techniques.

Opportunities for developing Core Skills

Numeracy (via fertiliser/lime/organic matter calculations), group work, and *Communication* skills (report writing) can all be developed in this Unit. The Unit also overtly assesses *Problem Solving* by asking the candidates to recommend appropriate management techniques.

Open learning

It would be difficult to deliver this Unit via Distance Learning solely. Much of the theory (basic soil properties, general methods of management) *is* amenable to candidates learning through workbooks etc, but the Unit is essentially about experiencing soils in the field. Study weekends could be organised to compliment electronic or paper-based formats however.

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: Soil Management

The Unit is designed to enable you to develop the skills necessary to assess the management requirements of soils. In order to do this, you will need to be able to describe soil properties, identify any potential or actual problems or opportunities, know about a wide range of soil management techniques, and choose appropriate techniques for particular situations.

You will be taken to sites in order to investigate their soil properties and discuss management requirements. All of this will be placed within the context of your particular subject area. You will also have practical sessions looking at the effect of soils on plant growth and/or environmental problems such as pollution.

Assessment may take the form of a report and in-class tests. The report will be based on one of the site visits and you will be asked to describe the soil properties, and to recommend suitable management requirements of the site (depending on your choice of end-use). Any in-class tests will consist of a series of questions asking you to describe the basic soil properties and techniques used eg to improve field drainage, increase water supply and optimise nutrient availability, etc.

On completion of this Unit you should be able to:

1 Describe main properties of soils.
2 Describe methods used to optimise the soil's supply of essential plant requirements.
3 Describe the soil management requirements of a site.