Higher National Unit specification

General information for centres

Unit title: Soils and Crop Establishment

Unit code: F1YC 34

Unit purpose: This Unit is designed to enable candidates to develop the Knowledge and Skills required to understand the nature and properties of soils, their management in respect of crop production, to plan the use of field machinery to manipulate soil environments and establish crops and to provide appropriate crop nutrition. Candidates are required to identify the factors that influence soil fertility and consider its sustainability and the impact of machines on soil structure and its effects on crop growth and development. Candidates will develop an ability to select cultivation, sowing, and fertiliser application equipment with due regard to the maintenance, or enhancement of good environmental condition.

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

1 Explain the significant characteristics of agricultural soils for crop production.
2 Explain the application of soil tillage and crop establishment equipment.
3 Explain the methods of assessing and modifying soil fertility.
4 Explain the operation, performance and management of equipment for distributing inorganic fertilisers.

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 centre there are no specific prior knowledge requirements for this Unit. However knowledge of agricultural crop production systems would be highly advantageous. This might be evidenced by possession of the HN Unit F1Y4 34 *Arable Crop Production*.

Core Skills: There are opportunities to develop the Core Skills of *Communication* and *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.

General information for centres (cont)

Assessment: Outcome 1 may be assessed by means of a practical assignment supported by a short question paper. Outcome 2 may be assessed using a short selection test and Outcomes 3 and 4 can be assessed by means of closed-book tests which use a mix of short answer and extended response questions.

Higher National Unit specification: statement of standards

Unit title: Soils and Crop Establishment

Unit code: F1YC 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

Explain the significant characteristics of agricultural soils for crop production

Knowledge and/or Skills

- Physical characteristics of soil
- Chemical characteristics of soil
- Soil profiles
- Cultivation
- Soil-water characteristics
- Environmental considerations

Evidence Requirements

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

- explain the physical and chemical characteristics of a given soil and the impact on crop productivity
- describe a soil profile and predict its reaction to cultivation
- explain the impact of texture and structure on the soil-water characteristics of two contrasting soils
- explain two conditions leading to environmental degradation of soil and for each condition explain a relevant mitigation measure

Assessment Guidelines

This Outcome can be assessed by means of a report based on a practical assignment considering a soil profile supported by about 10 short answer or restricted response questions to cover the remaining Evidence Requirements.

Higher National Unit specification: statement of standards (cont)

Unit title: Soils and Crop Establishment

Outcome 2

Explain the application of soil tillage and crop establishment equipment

Knowledge and/or Skills

- Tillage equipment
- Performance characteristics
- Crop establishment equipment
- Equipment selection
- Soil sustainability

Evidence Requirements

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

- explain the influence of two field and two equipment factors on the operational performance of two selected pieces of tillage equipment
- explain the layout and principles of operation of two contrasting pieces of crop establishment equipment
- select a matched set of crop establishment equipment for a given cropping and soil situation that sustains the soil structure and explain why the selection is appropriate

Assessment Guidelines

This Outcome could be assessed by means of a closed-book test and a short selection assignment. The choice of cropping and soils can be related to the candidate's experience.

Higher National Unit specification: statement of standards (cont)

Unit title: Soils and Crop Establishment

Outcome 3

Explain the methods of assessing and modifying soil fertility

Knowledge and/or Skills

- Soil fertility
- Nutrient supply
- Environmental impact
- Nutrient management

Evidence Requirements

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

- four factors that influence the fertility of soil
- one method for assessing the fertility of a given soil
- the application of three contrasting measures for modifying the nutrient status of soil
- the environmental impact of the supply of two selected nutrients to a specified soil
- how two specified management decisions may influence soil nutrient status

Assessment Guidelines

It is suggested that this Outcome could be assessed by a closed-book assessment consisting of a mix of approximately 15 short answer and restricted response questions. The assessment may be related to a site visit to a particular soil.

Higher National Unit specification: statement of standards (cont)

Unit title: Soils and Crop Establishment

Outcome 4

Explain the operation, performance and management of equipment for distributing inorganic fertilisers

Knowledge and/or Skills

- Fertiliser applicators
- Operational performance
- Management measures
- Environmental impact

Evidence Requirements

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

- ♦ the layout and mode of operation of two contrasting fertiliser applicators
- ♦ the influence of four significant factors on the operational performance of a given fertiliser applicator
- ♦ three management measures to enhance the effectiveness of fertiliser operations or environmental protection for a given cropping situation

Assessment Guidelines

This Outcome can be assessed by a closed-book test consisting of a mix of about 10 short answer and restricted response questions. It is envisaged that the assessment may include sketching of machine details.

Administrative Information

Unit code: F1YC 34

Unit title: Soils and Crop Establishment

Superclass category: SD

Original date of publication: August 2008

Version: 01

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: Soils and Crop Establishment

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 focuses on the understanding of the role of soils and nutrition of arable crop production. In particular it considers in detail the soil preparation, nutrition and planting stages of the production cycle. Hence it is concerned with an understanding of soil and crop interface. The context is primarily concerned with agricultural cereal crops within the context of commercial and environmental good practice. The four main areas of soil, cultivation, establishment and crop nutrition are each considered in a separate Outcome.

Outcome 1 considers the soil properties. Starting with the physical factors, such as the structure, texture and porosity, recognising the chemical characteristics, pH and organic matter content, leading to an understanding of the soil water regime. The importance of moisture storage, availability and drainage for the plant is discussed. The emphasis of this Outcome will be clearly focussed on understanding the soil, its profile and the conditions required by the crop whilst considering the environmental consequences on soil organisms and water supply.

Outcome 2 examines the role of tillage in potentially repairing soil profiles after damaged by tractors and harvesting operations. The objective is to produce a soil profile suitable for the intended crop considering water supply and rooting depth requirements. The profile will require a suitable seedbed which can be produced in various ways. Choosing which is appropriate requires knowing how the soil behaves and the range of suitable seedbed preparation options to minimise costs and achieve yield and income target.

Outcome 3 examines the soil nutrient condition; how much is available in the soil and the specific crop requirements. An understanding of fertility and nutrient elements helps to decide which of the alternative supplies is appropriate. The environmental considerations and potential for pollution are considered in conjunction with management practices designed to maintain soil potential.

Outcome 4 considers the techniques for the application of nutrients, both natural and artificial. The types and techniques of applicators are studied and observed. The factors which affect the operational performance are examined; the efficiency of the metering mechanism and types of fertiliser affect the machines performance as does the operating field technique. Accurate bout matching or marking, by tramlines, is critical for field accuracy. The options of on the move adjustments and linking applications to harvest yield mapping using GPS are common practice and allow integration with farm management systems.

Higher National Unit specification: support notes (cont)

Unit title: Soils and Crop Establishment

Guidance on the delivery and assessment of this Unit

It is recommended that this Unit be delivered through a series of lectures with supporting demonstrations and practical exercises.

Outcome 1: lectures on physical characteristics in conjunction with practical lab exercises identifying different soils types. Field observation of soil profiles would allow candidates to practice lab techniques as well identify and assess real soil profiles. Discussion about causes of soil problems and potential remedial actions would build the understanding within a farming framework. Assessment could include diagrams.

Outcome 2: lectures on types of cultivators with diagrams and videos of working machines. (example — Tillage events provide a unique opportunity to see all types of machines working in field). Diagrams of soil physical changes and use of soil clod breaking demonstrations will help candidates to be aware and choose from a range of tillage machines. Seedbed cultivations could be demonstrated using practical exercises. Different drill types can be studied on video or demonstration.

The assessment of this Outcome would need to ensure that candidates are aware of range of machinery as well as how to choose for given situation; suggesting that practice questions/ tutorials are required to build confidence in selecting machines. It is important that candidates can identify the weaknesses of machines and generally know why a machine is not suitable for a particular soil type.

Outcome 3: lectures and calculations of nutrient status, in conjunction with Arable Crops and Grass and Fodder crop Units.

Outcome 4: the lecture classes need to be complimented with demonstrations of equipment, and videos if possible. The practicalities of field operation and overlap for example are difficult to get across and assess, diagrams and examples of commercial tests may help. A practical exercise of calibrating a spreader would be the ideal.

Opportunities for developing Core Skills

There are opportunities for the candidate to develop Written Communication at SCQF level 6 in the assessment of all Outcomes. If candidates complete written work for each Outcome a they will an opportunity to develop the general skill ‘produce well structured written communication on complex topics’. Candidates when completing their responses to Outcomes will have to present essential ideas/information and supporting detail in a logical and effective order.

Candidates will have an opportunity to analyse a particular situation within Outcome 4. Candidates may analyse fertiliser application and justifying why it may be used in a particular situation. The general skill that candidates may have to complete is ‘Analyse a complex situation or issue’.

Higher National Unit specification: support notes (cont)

Unit title: Soils and Crop Establishment

Assessment of this Unit may allow candidates to develop the Reviewing and Evaluating component of the Core Skill *Problem Solving* at SCQF level 6. Candidates may have opportunities to gather evidence to support their evaluation and to draw conclusions. Candidates are able to gather their own evidence for Outcome 4 and to draw conclusions as to how to use management measures to enhance the effectiveness of fertiliser operations or environmental protection for a given cropping situation. The general skill that candidates may have to complete is 'review and evaluate a complex problem solving activity'.

Open learning

It is possible to offer this Unit by distance learning. Ideally, the candidate may need access to a wide range of farm machines for cultivation and crop establishment and to see their effects whilst in action to aid their understanding. Access to this equipment would require a degree of planning by the centre as many of the machines in question only operate once per year.

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: Soils and Crop Establishment

This Unit introduces you to the fact that production agriculture is primarily about the production of crops and livestock. This Unit is designed to let you look at the vital parts that soil condition and nutrient status play in cereal crop production. Seedbed and soil conditions must be right for the intended crop and this Unit considers the methods for creating these conditions through the application of appropriate cultivation and seed bed preparation techniques for field scale crops. Matching the equipment used to the condition of the soil and the crop to be grown is essential if soil structure is not to be harmed and the operations are to be profitable and so this module also considers the assessment of a soil, including its nutrient status, and the management of crop establishment.

Crop quality and yield rely heavily on the establishment techniques used and their timing. Hence you will consider the options available for sowing or planting the crop and the influence they have on the crop.

The nutritional status of the soils is also crucial to successful crop growth so, finally, the Unit assists you in investigating the options and machinery to administer initial and subsequent applications of nutrients such as fertilisers in an accurate and timely fashion. Given the damage that can be done to the environment if these machines are used incorrectly the Unit stresses good practice throughout.