

ASSESSMENT GUIDE FOR ASSESSORS & FACILITATORS

Plant Nutrition & Soil Management

Level 3

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Title:		Manage Soil Fertility and Plant Nutrition					
Applied Title:		Manage Soil Fertility and Plant Nutrition in a Citrus Production Environment					
Field:		Agriculture and Nature Conservation					
Sub-Field:		Primary Agriculture					
SETA (SGB):		AgriSETA					
Skills Area:		Plant Nutrition and Soil Management					
Context:		Citrus Production					
US No:	116267	Level:	3	Credits:	5	Notional Hours:	50
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Based on the Production Guidelines of:



Supported by:



Unit standard alignment and assessment tool development:

Cabeton Training and Development

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Directions

Please Note: There is a separate assessment guide for the learner. The learner must use this guide to prepare himself / herself for the assessment.

This assessment guide contains all necessary activities and instructions that will enable the assessor and learner to gather evidence of the learner's competence as required by the unit standard. This guide was designed to be used by a trained and accredited assessor whom is registered to assess this specific unit standard as per the requirements of the AgriSETA ETQA.

Prior to the delivery of the program the facilitator and assessor must familiarise themselves with content of this guide, as well as the content of the assessment guide for learners.

The assessor, facilitator and learner must plan the assessment process together, in order to offer the learner the maximum support, and the opportunity to reflect competence.

The policies and procedures that are applicable during the execution of this assessment are available on the website of the Citrus Academy, contained in a document named Policies and Procedures for Assessment, and must be strictly adhered to. The assessor must familiarise himself with this document before proceeding.

This guide provides step-by-step instructions for the assessment process of:

US No:	116267	Level:	3	Credits:	5
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The step-by-step instructions agree and are conducted in concert with the steps described in the learner assessment guide. The steps are as follows:

Step	Description	Timeframe
1	Pre-Assessment Briefing and Checklist	Before delivery of program
2	Learner Declaration of Authenticity	Before delivery of program
3	Diagnostic Assessment of Learning Assumed to be in Place	Before delivery of program
4	Assessment Plan for Gathering of Evidence	Before delivery of program
5	Learner Formative Assessment Activities	During delivery of program, assessment after delivery of program
6	Knowledge Questionnaire	After delivery of program
7	Integrated Summative Assessment Tool	After delivery of program
8	Re-assessment Procedures	After completion of assessment
9	Documentation	After completion of assessment
10	Administration and Completion of Portfolio of Evidence	After completion of assessment

Step 1

Pre-Assessment Briefing and Checklist

A pre-assessment briefing for learners is held before the delivery of the program. Use the checklist below to ensure that all these points are addressed and discussed with the learners.

Pre-Assessment Briefing Checklist		
	√	X
Organise resources – people, equipment, venue, etc.		
Explain the purpose of the assessment		
Discuss the standards or criteria to be used		
Discuss assessment roles and accountabilities		
Decide on assessment venues		
Negotiate evidence required, and where or how this evidence may be gathered		
Explain the methods of assessment that will be used during the gathering and summing up of evidence		
Negotiate the date of submission for the activity workbook and the date for the summative assessment		
Discuss resources required for the assessment e.g. equipment, materials, etc.		
Explain the procedure if the learner is found to be not yet competent		
Explain the appeal and review procedures		
Identify any potential learning barriers and negotiate strategies to overcome these		
Complete and sign the assessment plan with the learner		

The learner and assessor must sign the **Learner Contract** in the learner assessment guide.

Step 2

Learner Declaration of Authenticity

The learner is requested to complete and sign the Declaration of Authenticity in the learner assessment guide. This should be checked and co-signed by the assessor.

The format is as reflected in the learner assessment guide.



Step 3

Diagnostic Assessment of Learning Assumed to be in Place

In the learner assessment guide, the learner is asked to indicate whether they have completed the learning assumed to be in place as prescribed by the unit standard.

The assessor must guide the learners through this step, explaining in detail the content of the mentioned learning areas, because names of learning programs do not always agree with the names of the unit standards, and learners might indicate the incorrect information.

If learners indicate that they have not yet completed the mentioned unit standards, the assessor should prescribe an action plan to allow the learner to obtain the skills required by recommending additional training, competence portfolios, or the relevant RPL assessment for the given unit standards.

The format is as reflected in the assessment guide for learners. Please read it and familiarise yourself with its content.



Step 4

Assessment Plan for Gathering of Evidence

A pro-forma assessment plan for this unit standard has been drafted in the learner assessment guide. Explained the plan to the learner and complete the dates and signatures as indicated.

The format for the assessment plan is as reflected in the assessment guide for learners. Please read it and familiarise yourself with its content. Make a note of the dates agreed upon in the table provided below.

Learner and Assessor Assessment Plan		
Unit Standard	Manage Soil Fertility and Plant Nutrition	
Registration Number	116267	
<i>Step</i>	<i>Description</i>	<i>Completion / Submission Date</i>
Step 5	Learner Formative Assessment Activities	
Step 6	Knowledge Questionnaire	
Step 7	Integrated Summative Assessment Tool	
Step 8	Re-Assessment Procedures	
Step 9	Documentation	
Step 10	Administration and Completion of Portfolio of Evidence	

Step 5

Learner Formative Assessment Activities

The Learner Assessment Guide contains comprehensive activities and worksheets that the learner must complete during the delivery of the learning program. It is imperative that these activities be completed as part of the learning process in order to give the learner the opportunity to develop the skills, knowledge and attitudes that are required for competence.

Learners must complete all the activities in the workbook.

Learners must be encouraged to take control of their learning by indicating areas in the workbook where they experience difficulty.

Learners hand in the Learner Assessment Guide to the assessor or the facilitator, only if the facilitator is a subject matter expert, for the assessment of the formative assessment activities. The assessment of these activities must be done according to the prescribed benchmarks and according to the marking matrix that follows.

The learner must not move on to the next step before this step has been completed and learners show sufficient capacity and readiness for summative assessment. If problems areas are identified, the learner should be guided with a developmental action plan, which is documented separately and signed by the learner, the facilitator and the assessor.

Model answers are provided below.

Activity 1 – Group Activity Develop and draw a flow diagram of the steps that you would follow when you need to apply a granular fertiliser. Key Steps: 1. Obtain the instruction as to the type of fertiliser, concentration of the active ingredient and the mass to be applied. 2. Calculate the mass required to fertilise the mentioned orchard/s 3. Check the stores for stocks available. 4. Check the safety regulations required when handling this fertiliser. 5. Prepare measures for each staff member that will be involved in the actual application of the fertiliser that will scope the required mass. 6. Supervise the loading of fertilisers to ensure the correct type and number of bags are loaded. 7. Off-load the bags at appropriate intervals in the orchard. 8. Demonstrate the correct method of application. 9. Stress the safety regulations required handling this type of fertiliser. 10. Supervise the application 11. Collect and count the empty bags and estimate the mass of fertilisers in opened half-used bags. 12. Return empty bags to appropriate area. 13. Return half filled bags of fertilisers to the appropriate area. 14. Calculate the mass applied and compared to the mass required. 15. Investigate any discrepancies and report to the manager. Discuss these steps in your group according to the principles below, and make notes for yourself: Possible risk areas for the personal safety of the staff who is involved in the process.

Inhaling dust, possible irritation of skin and eyes.

Possible mistakes that can be made in the process and what the financial consequences of those mistakes might be.

- 1. Scoops not properly filled – Less than was instructed is applied, tress will experience stress resulting in lower production.**
- 2. Distribution uneven – Some areas will receive too little and others too much fertiliser. Too much due to uneven distribution can result in scorching of the roots, twigs and/or leaves with a resultant decrease in potential production and damage to the tree.**
- 3. Fertiliser is applied in the areas not wetted by the irrigation system – The trees will not be able to absorb the nutrients in time which could result in a decrease in yield and/or quality.**
- 4. Application of the wrong fertiliser – Incorrect type and concentration which could result in over or under supply of the nutrient with resulting poor yields.**

Possible impacts that the process or mistakes in the process might have on the ecological environment.

The major detrimental impact on the environment would result from applying too much due to the wrong fertiliser type. Concentration, poor calibration of measures and poor distribution.

Activity 2 – Case Study

Joe is a citrus farmer in the Limpopo province of South Africa. Two years ago he upgraded his irrigation system to a micro-jet system. Last year he changed from manual fertiliser to a fertigation system. He has found that the system works very well in some areas of his farm, but in a small area there are some problems.

He decided to resolve the plan step-by-step. He went out and beacons off the exact area where the problems are experienced. Then he checked exactly what kinds of problems were occurring. He identified the following:

Indicator: Two-year old and older leaves on the trees

Symptoms: A large number of the old leaves have a light yellow colour. These leaves started yellowing just before or during a new leaf flush with some immediate leaf drop after that.

Deficiency Identified: Nitrogen (N)

He then decided to consult an expert and increase the application of nitrogen (N) and potassium (K) in his fertigation program. Unfortunately the problem still did not improve. Then he decided to take some soil samples to see whether there might be any clues to be found in the soil. The laboratory results showed that the pH of the soil was high and that the clay content of the soil was also quite high. He then decided to include a super phosphate in his fertigation program, which helped to alleviate the problem.

Now answer the questions below:

What was the first indication that Joe had that there is a problem?

The trees did not yield as well as the rest and/or yellowing appears.

Explain in your own words what steps Joe followed to try and identify the reasons for the problem.

- 1. Identified area where problems occurred**
- 2. Determined plant part indicating possible deficiency**
- 3. Identified symptoms of deficiency**
- 4. Identified deficiency**
- 5. Identified cause of deficiency**

What would you have done differently?

I would have started by checking if the affected part gets the same volume of water and hence fertilisers at the correct time. If positive, I would have dug a profile pit next to the trees to inspect the roots. If that does not reveal any problems, I would pick a leaf sample and sample the soil to check any abnormalities.

Do not add more fertilisers until you are sure that the supply was insufficient.

The symptom resembles a nitrogen deficiency and could have been caused by too little N, too much leaching or a poor root system.

Do you think that Joe came to the correct conclusion and applied the correct solution to the problem? Motivate your answer.

He did not initially search out expert advice and thus came to wrong conclusion. Only once soil samples were taken and experts were called in, were the problems diagnosed correctly and treated.

Activity 3 – Worksheet

Complete the worksheet below.

Name three important considerations when calibrating for manual soil applications of granular fertilisers.

- 1. Collect the correct fertiliser**
- 2. Measure the required mass to be applied per tree**
- 3. Mark the container at the appropriate level or cut the extra clearance away to prevent any over supply.**

Name three major considerations when calibrating equipment to apply foliar nutrient sprays.

- 1. Orifice size**
- 2. Number of whiller plate**
- 3. Operating pressure.**
- 4. Gear selection to drive at the correct speed.**

Name the most important issue when applying fertilisers (nutrient solutions) by means of fertigation through micro-jets.

- 1. Correct type of fertiliser solution**
- 2. Beware of incompatibilities**
- 3. Apply the fertilisers at the correct sequence.**
- 4. Do not exceed the recommended concentration/mass/volume**
- 5. Do not apply too much water on top of the fertiliser.**

Activity 4 – Group Activity

To constantly achieve the same high quality result in sampling, it is a good idea to divide your sampling process into clear and effective steps. What do you think the steps for each stage of sampling should be?

- List the steps that you believe should be taken when taking leaf and soil samples.
- Next to each step, write down who would normally do it on a citrus farm.
- Write down the safety instructions that you would have to give to your team for each specific step.
- Write down any cautionary information that you would have to tell your team to ensure that the integrity of the sample is not compromised, meaning that the samples will not become confused or contaminated.

After finalising the group discussion and deciding on the best options, write them down in the sheet below and make key notes for your self.

<i>Step</i>	<i>Responsible Person</i>	<i>Safety Instructions</i>	<i>Cautionary Information</i>
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Select and demarcate a sampling unit consisting of trees of the same cultivar on the same rootstock of the same age.	Orchard or farm manager	Wear appropriate safety gear Use appropriate tools correctly and safely	
Select an index row or rows that will represent the orchard/sampling unit in all respects.	Orchard or farm manager	Follow the correct procedures	Mark the index rows in a manner that will last and easily be seen by the sampler.
Pick leaves according to the sampling procedure	Orchard or farm manager or trained farm worker	Ensure correct procedure is followed Wear eye protection Wear safety shoes Be alert to uneven terrain	Ensure that the right leaf is picked
Put the leaves of the sampling unit in a marked plastic bag	Sampler	Ensure correct procedure is followed Wear eye protection Wear safety shoes Be alert to uneven terrain	Ensure that the plastic bag is properly marked and check against the orchard map.
Keep the leaf samples in the shade until transported to the office.	Sampler	Ensure correct procedure is followed Wear eye protection Wear safety shoes Be alert to uneven terrain Wash hands after completion of task removing all residues	The sun is moving all the time. Ensure that the samples will still be in the shade a few hours later.
Take soil samples according to the prescriptions	Orchard or farm manager or trained farm worker	Ensure correct procedure is followed Wear eye protection Wear safety shoes Alert others to your actions Work safely with sharp implements	Collect sub-samples in a clean plastic bucket. Mix properly before the sample bag or carton is filled.
Key Notes:			
1. Correct leaf 2. Sub-samples for soil 3. Tie the bag air tight for leaves 4. Keep samples cool.			

Activity 5 – Worksheet

Discuss the questions below with a partner and write down the conclusions that you reach.

Why is it important to keep records of samples? What do you think these records could be used for?

As a control measure to check if all orchards intend to be sampled, have been sampled. To prepare the control sheet that should accompany the samples to the laboratory.

What could happen if no records were kept of samples?

**Usually the laboratory is blamed for the “missing” samples.
 How will one know which orchard were sampled
 No new/revised fertilisation program will be available on time.**

Activity 6 – Worksheet

Complete the worksheet below.

What will the result be of too high concentrations of the following elements on the quality of citrus fruit?

Nitrogen	Reduction in sugars levels Increase in acid content Delayed ripening Course skins Less juice Thicker skins Higher incidence of injured fruit Higher incidence of decay.
Phosphorus	Not likely to affect quality but the acids can be reduced.
Potassium	Reduction in sugars levels Increase in acid content Course skins Less juice Thicker skins Too many too large fruit

Apart from increasing the application rate of fertilisers, how can a too low status of the following nutrient elements be corrected?

Nitrogen	Change the formulation Split the application Reduce the leaching losses Foliar sprays Correct root diseases
Potassium	Change the formulation Split the application Reduce the leaching losses Foliar sprays Correct root diseases
Iron	Reduce water logging by improving water scheduling Acidify the soil by means of ammonium nitrogen or acids.

Activity 7 – Group Brainstorm

Brainstorm as a group and find answers to the questions below. You may refer to your level 2 learner guide if necessary.

What are the physical soil properties?

1. **Texture**
2. **Structure**
3. **Layering**
4. **Soil depth**
5. **Aeration**

What are the chemical soil properties?

1. **pH**
2. **Resistance**
3. **Organic material**
4. **Salinity**
5. **Fertility**

What kinds of impact might these properties have on plants and plant nutrition?

Direct and indirect by influencing the properties of the soil, the environment and then the growth and production of the trees.

The impact that we have discussed above may be direct or indirect. The impact of physical properties is mostly indirect, while the impact of chemical properties is mostly direct. Give a practical example of a direct impact that the chemical properties of soil might have on the nutrition of a plant?

When the pH of the soil is either too low or too high, the solubility of the nutrients are affected.

A too low resistance means that the soil contains too much soluble salts which creates imbalances and hence under nutrition.

Salinity creates imbalances and toxic conditions.

Give a practical example of an indirect impact that the physical properties of soil might have on the nutrition of a plant?

As per learner context, for example:

The structure of the soil is responsible for the aeration, root penetration and movement of water. When the structure collapses the plants cannot reach the nutrients due to impaired root development.

Activity 8 – Worksheet

Complete the worksheet below.

Give reasons why the following physical and chemical properties of soils will impact on plant nutrition.

Physical Properties

Texture	The higher the clay content, the stronger will cations be absorbed on the clay and less will be available to the plants.
Structure	The structure of the soil is responsible for the aeration, root penetration and movement of water. When the structure collapses the plants cannot reach the nutrients due to impaired root development.
Soil Layering	Layering restricts water movement, drainage and root development and hence less soil volume can be explored.
Soil Depth	Less soil volume is available.
Aeration	Roots need oxygen to absorb nutrients and water and to develop.

Chemical Properties

PH	The optimal ph of the soil is 6.50 to 7.50. Beyond that too much or too little nutrients will be in solution or too much toxic ions will be present.
Resistance	Too high resistance indicates a low fertility level and too low resistance saline conditions.
Salinity	Salinity is associated with too much salts in the soil, degradation of the structure and generally poor conditions.
Organic Material	Organic matter can protect some nutrients from leaching, is a source of root stimulants but too much will impact on fruit quality and the nitrogen release cycle of the soil.
Fertility	Trees need nutrients and an infertile soil cannot supply.

Activity 9 – Worksheet

Complete the worksheet below.

Describe the positioning of a profile pit.

Usually at the top middle and lower ends of the natural slope.

Describe the major components of a soil profile.

Horizons are the different layers as can be seen on the sides of a profile pit. These layers have different chemical and physical properties which distinguish them. The sequence of these layers are used to characterised and described the soil.

The components are usually the top layer or Organic horizon, the A horizon which is normally the cultivated layer, the B horizon which represents the subsoil and the parent material from which the soil derives.

Describe the use of profile pits to initiate a soil map.

The profile pit is used to identify the soil in terms of horizons and depth. Soil classification is based on the properties of the soil profile and is used to group identical soil types together and to draw a map of the different types.

Activity 8– Group Activity

In your group, revise what you have already learnt about soil preparation by drawing a mind map. Refer to your level 2 learner guide is necessary.

Soil with optimal properties is not always available for cultivation, and steps can be taken during soil preparation to correct or at least improve the conditions.

For example:

Soil Preparation



Take soil samples

Dig profile pits
 Mark profile pits on map
 Take samples at correct depths
 Send samples for analyses



Physical Improvement

Break up hard layers
 Remove occurrence of water tables
 Improve drainage

Chemical improvement

Determined by soil analyses
 Improve deficiencies
 Improve pH
 Correct excesses



Clear veld

Discuss the questions below in your group and complete.

What are the different methods of soil preparation?

1. Loosening without mixing
2. Loosening by mixing
3. Ridging

What do you know about mechanical soil preparation?

It is the process during which the physical and chemical properties of the soil are improved to get closer to the optimal requirements of the trees.

What do you know about non-mechanical soil preparation?

Possibly hand-tilling; loosening soil with a garden fork; levelling soil surface with a rake

Activity 10 – Worksheet

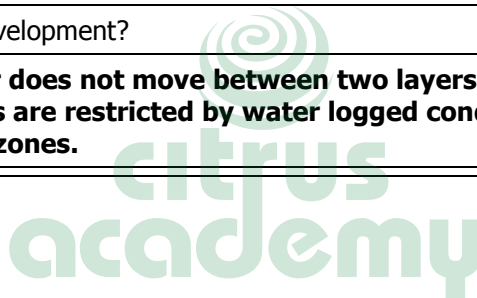
Complete the worksheet below.

What is the basic requirement of the soil in the root zone?

Well aerated at a neutral pH supplying adequate nutrients and water.

How will layering restrict root development?

Roots do not grow and water does not move between two layers with widely different textural properties. The roots are restricted by water logged conditions and different soil strengths in the transitional zones.



Marking Matrix and Assessor Report for Formative Assessment Activities
Formative Evidence Collection Summary for Unit Standard 116267 – Level 3

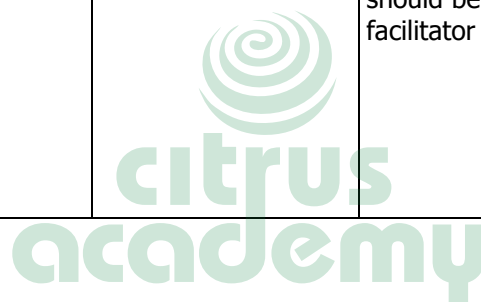
	<i>Action Required from Learner to Develop Competence</i>	<i>Competence Assessments</i>	<i>Standard for Activity</i>	<i>Allocation of Marks</i>	<i>Feedback to Learner and Comments on Evidence</i>
<i>Specific Outcome 1: Prepare for soil nutrient applications using specialised equipment</i> <i>Range:</i> Nutrient application refers to but is not limited to fertiliser or compost spreaders and planters	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct	As per model answer sheet	
<i>Specific Outcome 2: Supervise the collection of samples, storage and dispatch of samples to appropriate service providers</i> <i>Range:</i> Samples for leaf, soil and fruit analysis	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct	As per model answer sheet	
<i>Specific Outcome 3: Demonstrate an understanding of the properties of soil and how these impact on plant nutrition and soil preparation</i> <i>Range:</i> Soil properties may include chemical, physical and biological properties	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct	As per model answer sheet	

Marking Matrix and Assessor Report for Formative Assessment Activities
Formative Evidence Collection Summary for Unit Standard 116267 – Level 3

	<i>Action Required from Learner to Develop Competence</i>	<i>Competence Assessments</i>	<i>Standard for Activity</i>	<i>Allocation of Marks</i>	<i>Feedback to Learner and Comments on Evidence</i>
Specific Outcome 4: Identify and interpret symptoms of nutritional deficiencies in various crops and make basic recommendations <i>Range:</i> Macronutrients may include among others nitrogen, phosphorous, potassium and calcium. Micronutrients may include among others boron, zinc, iron and manganese. Simple recommendations on steps to correct nutrient deficiencies	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct	As per model answer sheet	
Specific Outcome 5: Supervise and implement soil preparation and remediation <i>Range:</i> Soil preparation methods refer to mechanical and non-mechanical approaches, minimum tillage, no tillage and both primary and secondary soil preparation. Remediation includes methods of dealing with acidity and aluminium or iron toxicity, water logging, compost making, etc.	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct	As per model answer sheet	

Marking Matrix and Assessor Report for Formative Assessment Activities Formative Evidence Collection Summary for Unit Standard 116267 – Level 3					
	<i>Action Required from Learner to Develop Competence</i>	<i>Competence Assessments</i>	<i>Standard for Activity</i>	<i>Allocation of Marks</i>	<i>Feedback to Learner and Comments on Evidence</i>
Embedded Knowledge: The learner is able to demonstrate a basic knowledge of: 1. Sampling procedures 2. Chemical, properties of soil – pH, nutrient status 3. Physical properties of soil – texture, structure, soil profiles 4. Biological properties of soil 5. Soil ecology e.g. soil organisms, food webs, role of water and oxygen in soil 6. Soil health and conservation 7. Role of living organisms 8. Conservation practices – runoff control, contours 9. Tillage operations – mechanical, non-mechanical, organic, minimum and zero tillage and application of nutrients (liquid and solid) 10. Primary and secondary soil preparation methods 11. Soil preparation and fertiliser application equipment 12. Nutrients – mixtures, limes, calcite and dolomite lime, single nutrients and compost, liquids, etc. 13. Calibration of equipment	Attend classroom lesson, participate and ask questions	Activities in learner activity book were completed correctly	Activity answers must be at least 85% correct	As per model answer sheet	
US CCFO: Identifying	Attends all lessons,	Attendance register	Learner must at least	N/a	

Marking Matrix and Assessor Report for Formative Assessment Activities Formative Evidence Collection Summary for Unit Standard 116267 – Level 3					
	<i>Action Required from Learner to Develop Competence</i>	<i>Competence Assessments</i>	<i>Standard for Activity</i>	<i>Allocation of Marks</i>	<i>Feedback to Learner and Comments on Evidence</i>
US CCFO: Working	activities, practical and completes activities and workbook as per instructions	and facilitator report	be present and no negative commentary about the learner should be made in the facilitator report.		
US CCFO: Organising					
US CCFO: Communicating					
US CCFO: Science					
US CCFO: Demonstrating					
US CCFO: Contributing					
US CCFO: Collecting					



Assessment Feedback Form – Activity Workbook			
		Comments / Remarks	
Feedback to learner on assessment			
Feedback from learner to assessor			
Learner's Signature		Date:	
Assessor's Signature		Date:	



Step 6

Knowledge Questionnaire

Before the summative task is undertaken, the learner must be reminded of what is expected from him / her in terms of summative and reflexive competence. Read and explain to the learner this section in the learner assessment guide. The learner and assessor must sign off this section to acknowledge that this step was completed.

- Use the planning and questioning format below to help you collect evidence for foundational and embedded knowledge as prescribed by the outcomes of the unit standards.
- Provide the questions as listed to the learners as a guide.
- Ensure that you apply the exact same methodology for each learner in order to ensure that VACS principles are adhered to.
- The benchmark for learner competence is an 85% overall questionnaire score.
- Only a suitably qualified and registered assessor who is ALSO a subject matter expert in this specific field can mark this assessment tool for learner assessment.
- If no such a person can be found to assess the learner, then it is advised that a qualified assessor consults with the appropriate subject matter expert prior to the assessment in order to establish key points for competence and / or uses model answers as supplied by a subject matter expert to allocate marks. The subject matter expert should be consulted for any answers that the assessor might have queries on.
- Use a header in the following format for each questionnaire paper:

Unit Standard:	116267	NQF Level:	3
Learner Name			

- The assessor should copy and paste as required and hand out questionnaire to learners.
- Marks and scores should be allocated

Questionnaire Questions

Model answers are provided below.

Explain how you would mix fertiliser to apply through:
• A dripper system (fertigation)

Two methods are possible, being: To prepare a single strength mix add the acids (nitric of phosphoric acid) first, followed by the nitrates (potassium, magnesium and ammonium, calcium) then the phosphates and sulphates and lastly the micronutrients. Mix continuously. Secondly, the so called stock solutions can be prepared where the concentrations are up to 250 fold higher than that of the single strength solution. In this case use at least 2 different containers. Add the acids (nitric of phosphoric acid), nitrates plus ammonium, sulphates and potassium salts to the one container. Add the calcium nitrate, magnesium nitrate and micronutrients to the second container. NB never mix magnesium and phosphates or calcium and sulphates in a concentrated solution. Do not mix micronutrients with the acids in the concentrated form. The stock solutions must be diluted to form a nutrient solution of single strength before it reaches the trees. This is usually done during irrigation when a volume of the stock solutions is added to the water while the irrigation system is in operation.

- Foliar application

Two principles are involved:

- The chemistry of the different products must be compatible. Do not mix calcium with a sulphate or zinc nitrate with a product with an alkaline pH.
- The correct time of application of each product must be the same.

Explain in you own words what calibration means?

Calibration of an instrument means the process required to ensure that the instrument will deliver or measure the correct volume, mass or reading when used in a process of measuring a volume, mass or reading.

Make a list of equipment that would need to be calibrated during the fertilisation process.

- Mass meter (or balance)
- pH meter (in the case of fertigation)
- Volume meter or dispenser (in the case of fertigation)
- Proportion pump (in the case of fertigation)
- Water pump (in the case of fertigation)
- Mechanical fertiliser applicator
- Containers used to measure the appropriate mass before spreading on the soil

What does the zeroing of a scale have to do with calibration?

During zeroing the electronics of the mass meter is set or re-set to read the load on the weighing pan as zero. When a certain mass is being measured into a container, put the container on the balance. Pressing the zeroing button and the balance will ignore the mass of the container. Now measure the appropriate mass into the container.

Do you think that a general farm worker is involved in the calibration of fertilisation equipment? Explain your answer.

No, apart from the requirements of reading and writing and to make the appropriate adjustment to the equipment to optimise its operations, the responsibility of applying the correct mass/volume or reading should be with a more senior person.

Write a job card in order to explain the following to another member of your team: "Collect 100 kilograms of Manganese Sulphate for application as a foliar spray in a dose of 200 grams per 100 litres of water."

As per learner's own perspective

In your own words, describe why you think it would be important to take samples of each of the following:

- Leaves

Leaf analysis is the most reliable method to measure the nutritional status of the trees. Leaf analysis tells what the trees could absorbed from the soil and if the mass absorbed will be enough, too little or too much to support optimal production.

- Soil

Soil analysis is the only way to measure the suitability of the chemical environment in the root zone for optimal citrus production. Soil analysis assists in deciding how to correct chemical deficiencies and imbalances.

Explain whose duty the taking of the following samples would be on a citrus farm:

- Leaves

Leaf sampling should be done by a trained staff member who can distinguish between a leaf on a fruiting and a non-fruiting twig. The complete fertilisation program is based on leaf analyses and should be supervised by a senior staff member.

- Soil

Soil sampling should be done by a trained staff member. Fertilisers are not applied to the whole orchard surface and the concentration of the nutrients will vary considerable over a small distance. Soil sampling should be supervised by a senior staff member.

Describe briefly in your own words how to take a leaf sample.

- **Divide the orchards into units of the same cultivar, rootstock, age and soil type. One unit should not be larger than 5 ha.**
- **Demarcate the index trees in the orchard and mark them for future reference.**
- **Select one or two leaves from behind a fruit on each tree in the index block.**
- **Ensure that the leaf picked is from the same spring flush as the fruit.**
- **Pick 50 to 100 leaves per index block.**
- **Put the leaves in a clean plastic bag, squeeze out the air and knot tight.**
- **Mark each sample with the appropriate name of the farm and orchard.**
- **Keep refrigerated until the samples can be send to the laboratory for analyses. Do not freeze the samples.**

Describe briefly in your own words how to take a soil sample.

- **For routine fertiliser recommendations, soil samples are taken from the trees in the index blocks.**
- **Collect 15 to 20 sub-samples per index block as follows;**
- **Remove the debris on the orchard floor below the drip line of the trees.**
- **Use an auger or spade and take a core or slice from the surface to a depth of 30cm.**
- **Collect the cores or slices (sub-samples) from 15 to 20 trees in a clean plastic bucket.**
- **Mix the sub-samples properly and transfer 500g to a suitable container.**
- **Mark each sample with the appropriate name of the farm and orchard.**
- **Keep indoors until the samples can be sent to the laboratory for analyses.**
- **Where drip irrigation and fertigation are practised, the sub-samples must be taken from between the outlet of the dripper and the peripheral of the wetted zone. Where two wetted zones touched, the sub-sample should be taken between the drippers. Discard the top 5cm of soil.**

Describe briefly in your own words how to take a soil sample.

Samples intend for off-farm analyses must be labelled, logged into a sample dispatch book, packed into a suitable container with a list indicating the type and number of samples, their identification numbers/names and the request of analyses to the laboratory.

Give an example of one service provider who can help you with the analysis of leaf and soil samples.

Central Analytical Laboratories at 012-305 5003.

Explain the physical properties of soil in your own words.

The physical properties of a soil includes the texture, structure, water holding capacity, porosity, depth, layering, impermeable layers and cation exchange capacity.

Explain the chemical properties of soil in your own words.

The chemical properties include pH, electrical conductivity (or resistance), nutrient content, and level of salinity (Na and Cl).

What would happen if:
You applied a foliar spray with a mist blower on a windy day?
The material will drift to other areas and the foliar spray will dry-out too quickly and be less effective.
You applied a too strong fertiliser mix to your orchard?
An over supply of fertilisers (too strong fertiliser mix) will create salinity due to too much soluble salts and imbalances. The saline conditions may scorch the roots, leaves and even twigs resulting in a lower yield or death of the trees. The effect will last as long as the salts (fertilisers) remain in the root zone. The imbalances will suppress the uptake of other ions creating deficiencies and loss of crop.
You forgot to fertilise as per recommendations?
Nutrient deficiencies will occur, with the symptoms depending on the type of fertiliser that was not applied. The first effect will be a decrease in yield and/or fruit size followed by quality problems.
What would be your recommendation for soil preparation if:
There is a very hard rock layer approximately 30cm under the topsoil.
If there is other site with deeper soil, do not plant citrus in this soil. If you must plant citrus, cultivate the top 30cm and then prepare ridges to give a topsoil depth of 40cm to 45cm. Do not remove all the soil from between the ridges to the ridges.
There is a distinct colour difference between soil horizons at a depth of 60cm.
Unfavourable conditions at a depth of 60cm will have an unfavourable impact on the performance of the trees. The difference in colour can be due to differences in clay content or can be a symptom of poor drainage or lateral movement of fine particles. Increase the depth of the profile pit in order to see if an impervious layer could be the reason. Take profile samples to determine if a difference in clay or minerals could be responsible. Do not continue with the preparation until the problem is solved.
What would be the visible defect in a citrus tree if there was too little of the following macro nutrient element available:
Nitrogen
The trees will turn light green followed by movement of nitrogen from the older to the younger leaves. This will result in a sparser foliage cover due to premature drop of older leaves. Twigs will bear only one or at the most two generations of leaves on their tips. Yield will decrease.
Phosphorous
Fruit will appear over mature while still in their prime. The centres of the fruit will be open and the fruit will turn soft. The skins will be thick and course and the juice content will decrease.
Potassium
Fruit size will decrease while the skins will be thinner and smooth with more juice and less acids.
Calcium
The soil conditions will first show the effect of a calcium deficiency when the run-off increases. Sporadic deficient supply of calcium during the first 60 to 75 days of the life of a fruit will increase the incidence of creasing.
What would be the visible defect in a citrus tree if there were too little of the following micro nutrient element available:
Boron

The most detectable symptom is smaller fruit with gumming in the albedo. The skin tends to be hard and may crack. Leaf symptoms show that the midribs are cracking at the under side giving a corklike appearance.
• Zinc
The first symptoms will appear on the new growth where the leaves will be mottled and smaller. The internodes are also shorter. Zinc deficiencies resemble that of manganese but unlike manganese the leaf size is reduced. Fruit size might be reduced.
• Iron
Young leaves in the shade and inside the canopy appear light green with veins still greener than the lamina. A very fine network of veins is visible on a light green background. The size of the leaves is normal.
• Manganese
Manganese deficiency resembles that of zinc but unlike zinc the leaf size is normal or unaffected. Mottles appear on new leaves of normal size.
What is the purpose of mulching?
Mulches are means to reduce evaporation of water from the surface of the soil. Another purpose of mulching is to reduce the temperature of the soil surface.
Why would we add compost to soil in a citrus orchard?
Compost is applied to increase the content of organic matter in the soil. By increasing the organic content of the soil the microbial population will increase and diversify generating other positives like improved structure, aeration and water and cation holding capacity.
Do you think that adding fertiliser to soil can improve the soil? Explain your answer in detail.
Yes. If a soil lacks phosphorus, the soil's potential will be improved by adding phosphate fertilisers. The same applies to any other fertiliser. In fact, plants can grow well and produce without anything else than water, air and fertilisers. The soil acts as the reservoir of nutrient for the commercial crops.
Explain in your own words what does it mean to rip soil?
Ripping is the term used to loosen the soil profile without turning the soil upside-down. The implement used is called a ripper and various models are available to suit the require cultivation action.
Do you think that all soil should be ripped? Explain your answer.
The majority of soils in their natural condition is too strong for the roots of commercial grown trees to penetrate and must be loosened. Ripping is one means to loosen the soil. Although not all soils will need ripping, if a soil needs to be loosened, ripping will be a good option. Some soils will require a mixing cultivation action and then ripping per se will not be required but can form part of the program.
Do you think that you should till all soil? Explain your answer.
Tilling is a method of soil preparation and should be selected as and where required. The soil profile will dictate which preparation methods are required and all soils will not require tilling.
Explain in your own words what you understand by the term soil ecology?
Soil is a living entity consisting of physical, chemical organic and biological components. These components are interrelated and interdependent and form the ecology of the soil. By changing one component the rest will react. The whole system will reach equilibrium under a set of unchanged conditions.
Give a practical example on a citrus farm of how soil health and soil conservation can be promoted.

The principle will be to get and keep the soil in a chemical, physical and biological condition that will support optimal sustainable citrus production. Therefore get the soil in a chemical balanced state (apply fertilisers), promote actions that will not destroy the physical condition (correct cultivation) and maintain the biological life without sacrificing the crop (yield and quality) in an economic viable manner. This is far from being sorted out, especially for tree crops where organic matter can destroy the crop.

Explain in your own words what you understand by the term run-off control.

Run-off refers to irrigation water not being absorbed by the soil. This is due to an application rate exceeding the penetration rate of water into a specific soil. The application rate can be too high due to faulty emitters, poor design or a change in the absorption capacity of the soil. The absorption capacity of the soil will decrease naturally or due to a decrease in the calcium saturation of the very top layer of soil or less organic material in the soil. To control run-off these factors must be controlled and maintained at an optimum level.

Explain what role contours can play in soil conservation practices on a citrus farm.

Contours are design to limit the flow rate of water to minimize erosion of topsoil. In commercial citrus, contours are only used on steep slopes. Otherwise the orchards are designed to control the flow of rainwater through the roads that are covered by vegetation, mostly perennial grasses. Contours are being seen as the last resort because they made other orchard practises like operating spraying equipment and picking trailers difficult.

Do you think that soil preparation that stops as soon as you have completed the primary preparation of the soil, in other words, when you are ready to plant you Citrus trees for the first time? Motivate your answer.

Yes. Soil preparation should stop when the trees have been planted. The challenge is to maintain the prepared soil in an optimal condition. Soils will naturally get compacted again but the process can be slowed down by proper orchard practises and traffic control.

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Step 7

Integrated Summative Assessment Tool

Two assessment tools are provided in this step, being:

1. Practical Assessment Tool
2. Attitudes and Attributes Assessment Tool

These assessment tools have been drafted in its entirety and follows below. It must be copied and completed for every learner in the same manner and according to the same procedure.

Learners must not be given these tools in preparation for summative assessment. This corresponding step in the learner assessment guide is a direct reflection of these tools and is drafted in a format that is appropriate to the learner's level of language competence.

1. Practical Assessment Tool

- All the sections of this document must be completed and signed where appropriate by the learner and the assessor.
- The learner must be given appropriate feedback and told whether they were declared competent or not yet competent. The assessor must record the appropriate commentary and guide the learner with detailed action plans for areas where the learner is found not yet competent.
- In line with the policies and procedures, the assessor must offer learners an opportunity for feedback on the assessment as well as an opportunity to appeal against the declaration.
- Should learners be found not yet competent, a detailed action plan with specific commentary on development must be drafted together with the learner and the facilitator in order to develop the necessary competence. A date for re-assessment must be agreed upon with the learner.
- All the evidence must be signed and copied, if necessary, to be placed in the learner's portfolio of evidence.
- Use this checklist to help collect evidence of practical competence as prescribed by the specific outcomes of the unit standards.
- Ask the questions as listed in order to test foundational and reflexive competence relevant to the specific task.
- Ensure that the exact same methodology is applies for each learner in order to ensure that VACS principles are adhered to.
- The benchmark for learner competence in this tool is 85% in EVERY task.
- This assessment tool can only be used for learner assessment by a suitably qualified and registered assessor who is ALSO a subject matter expert in this specific field.
- If no such a person can be found to assess the learner, then it is advised that a qualified assessor consults with the appropriate subject matter expert prior to the physical assessment in order to establish key points for observation. The subject matter expert should attend the assessment in order to judge competence of the learner.

2. **Attitudes and Attributes Assessment Tool**

- Use this rating scale to judge the learner's CCFO competence according to the unit standard.
- The learner's entire performance and all the stages of learning, as well as all gathered evidence must be considered for this section.
- It is advised that the assessor consult with facilitators, mentors, coaches and supervisors in order to ensure that an objective rating is allocated.
- A rating between 1 and 5 should be given, as follows:

Rating	Description
1	No evidence can be found
2	The evidence found is weak and this is still a major development area for the learner
3	The evidence found meets the average expectation for a learner on this level
4	The evidence found is of a high quality and exceeds the average standard expected
5	The evidence found is outstanding and the learner attitudes and traits are very well developed

- Learner must be given constructive feedback on each rating.
- Ensure that you apply the exact same methodology for each learner in order to ensure that VACS principles are adhered to.
- The benchmark for learner competence in this tool is 3:5 in EVERY CCFO.

At the end of this step, an assessment feedback form is provided which must be completed and signed by the assessor, learner and moderator, where applicable.



Practical Assessment Tool				
Unit Standard:	116267	NQF Level:	3	
Learner Name				
Tasks and Question	Criteria Checked For / Key Concepts Observed (to be completed as per the real contexts and examples used whilst in the field)	Learner Competent	Learner Not Yet competent and Recommended Revision	Assessor Comments
All sections of this tool must be used during the practical completion of duties, and learners should physically show and explain or simulate and explain all concepts listed below.				
Task 1: Prepare for soil nutrient applications using specialised equipment				
1.1. The ability to use specialised equipment is demonstrated				
1.2. The ability to calibrate specialised equipment is demonstrated				
1.3. The ability to collect the appropriate nutrients for application from storage facilities is demonstrated				
Task 2: Supervise the collection of samples, storage and dispatch of samples to appropriate service providers				
2.1. The ability to take and handle leaf, soil and fruit samples according to prescribed procedures are demonstrated				
2.2. The process of recording and dispatching the samples to the appropriate service provider is explained				

Task 3: Identify and interpret symptoms of nutritional deficiencies in various crops and make basic recommendations				
3.1. The relationship between plant abnormalities and deficiencies of specific macro- and micro-nutrients is explained				
3.2. Basic recommendations for improving soil fertility are made				
Task 4: Supervise and implement soil preparation and remediation				
3.3. An understanding of the special cultivation needs of various soils is demonstrated				
3.4. Appropriate implements and/or methods for soil preparation are selected				



Attitudes and Attributes Assessment Tool

Use the following rating table in this assessment:

Rating	Description
1	No evidence can be found
2	The evidence found is weak and this is still a major development area for the learner
3	The evidence found meets the average expectation for a learner on this level
4	The evidence found is of a high quality and exceeds the average standard expected
5	The evidence found is outstanding and the learner attitudes and traits are very well developed

CCFO Criteria	Rating
Identifying – The learner can identify problems and deficiencies correctly.	
Working in a Team – The learner is able to work well as member of a team.	
Organising – The learner works in an organised and systematic way whilst performing all tasks and tests.	
Communicating – The learner is able to communicate his or her knowledge orally and in writing, in a way that shows what knowledge he or she has gained.	
Demonstrating – The learner is able to show and perform the tasks required correctly.	
Contributing – The learner is able to link the knowledge, skills and attitudes that he or she has acquired in this module of learning to specific duties in their job or in the community where he or she lives.	
Science – Learner is able to utilise and use science and technology effectively	
Collecting – Learner can effectively gather information	



Assessment Feedback Form			
		Comments / Remarks	
Feedback to learner on assessment and / or overall recommendations and action plan for competence			
Feedback from learner to assessor			
Assessment Judgement	You have been found: ☐ Competent ☐ Not yet competent in this unit standard	Actions to follow: ☐ Assessor report to ETQA ☐ Learner results and attendance certification issued	
Learner's Signature		Date:	
Assessor's Signature		Date:	
Moderator's Signature		Date:	

Step 8

Re-Assessment Procedures

- Note that only outcomes on which the learner was found not yet competent must be re-assessed.
- The same procedures in steps 6 and 7 are repeated.
- The tool must be adapted at discretion of the assessor. Best practice is not to present the exact same format and questions if possible.
- Use your expertise and judgement to ensure that the method of re-assessment remains integrated and relevant to the expected outcomes.



Step 9

Documentation

The following documentation is addressed in this step:

1. Learner and assessor information reports;
2. Assessor report and summative evidence collection summary;
3. Learner assessment re-actionnaire;
4. Assessor's assessment review and improvement document;
5. Assessment appeal form

1. Learner and Assessor Information Forms

The learner information form is in the assessment guide for learners. The assessor information form follows. These forms must be completed for each individual learner and placed in the learner's portfolio of evidence.

2. Assessor Report and Summative Evidence Collection Summary

This report follows after the information report. Use it to summarise the findings during assessment. Please complete the copy of this report that is in the learner assessment guide.

3. Learner Assessment Re-Actionnaire

A pro-forma for the learner assessment re-actionnaire is included in the learner assessment guide. Ask the learner to complete this form and sign it.

4. Assessor's Assessment Review and Improvement Document

The assessor is expected to complete the assessor review of the assessment process, using the pro-forma document of which an example follows. Please complete the copy of the document in the learner assessment guide. This document must be discussed with the learner and any learner commentary should be recorded.

5. Assessment Appeal Form

The assessment appeal form is also provided in the learner assessment guide. Assist the learner to complete the document if necessary.

The learner must be requested to sign-off all reports and documents before they are placed in the portfolio of evidence.

Assessor Information Form			
Unit Standard	116267		
Program Date(s)			
Surname			
First Name			
Company Name			
Job / Role Title			
Home Language			
Gender	Male	Female	
Race	African	Coloured	Indian/Asian White
Employment	Permanent	Non-permanent	
Disabled	Yes	No	
Date of Birth			
ID Number			
Contact Telephone Numbers			
Email Address			
Postal Address			

Assessor Report and Formative and Summative Evidence Collection Summary for Unit Standard 116267 – Level 3					
Description	Evidence Gathered		Benchmark	Competent / Not yet Competent	Feedback and Comments
	Foundational and Embedded Knowledge	Practical Skills, Underpinning Knowledge and Reflexive Competence			
Specific Outcome 1: Prepare for soil nutrient applications using specialised equipment <i>Range:</i> Nutrient application refers to but is not limited to fertiliser or compost spreaders and planters	Summative Test	Observation checklist of practical tasks integrated with knowledge and reflexive competence questionnaire	85% competence in all areas		
Specific Outcome 2: Supervise the collection of samples, storage and dispatch of samples to appropriate service providers <i>Range:</i> Samples for leaf, soil and fruit analysis	Summative Test	Observation checklist of practical tasks integrated with knowledge and reflexive competence questionnaire	85% competence in all areas		
Specific Outcome 3: Demonstrate an understanding of the properties of soil and how these impact on plant nutrition and soil preparation <i>Range:</i> Soil properties may include chemical, physical and biological properties	Summative Test	Observation checklist of practical tasks integrated with knowledge and reflexive competence questionnaire	85% competence in all areas		

Assessor Report and Formative and Summative Evidence Collection Summary for Unit Standard 116267 – Level 3					
Description	Evidence Gathered		Benchmark	Competent / Not yet Competent	Feedback and Comments
	Foundational and Embedded Knowledge	Practical Skills, Underpinning Knowledge and Reflexive Competence			
Specific Outcome 4: Identify and interpret symptoms of nutritional deficiencies in various crops and make basic recommendations <i>Range:</i> Macronutrients may include among others nitrogen, phosphorous, potassium and calcium. Micronutrients may include among others boron, zinc, iron and manganese. Simple recommendations on steps to correct nutrient deficiencies	Summative Test	Observation checklist of practical tasks integrated with knowledge and reflexive competence questionnaire	85% competence in all areas		
Specific Outcome 5: Supervise and implement soil preparation and remediation <i>Range:</i> Soil preparation methods refer to mechanical and non-mechanical approaches, minimum tillage, no tillage and both primary and secondary soil preparation. Remediation includes methods of dealing with acidity and aluminium or iron toxicity, water logging, compost making, etc.	Summative Test	N/a	Overall minimum test score of 85%		

Assessor Report and Formative and Summative Evidence Collection Summary for Unit Standard 116267 – Level 3					
Description	Evidence Gathered		Benchmark	Competent / Not yet Competent	Feedback and Comments
	Foundational and Embedded Knowledge	Practical Skills, Underpinning Knowledge and Reflexive Competence			
Unit Standard CCFOs: • Identifying • Working in a Team • Organising • Collecting • Communication • Science • Demonstrating • Contributing	N/a	Rating Scale	Minimum rating of 3:5 in each criteria or overall average of 3:5		

Assessor's Assessment Review and Improvement Document	
<i>Issues</i>	<i>Comments</i>
Did the assessment go according to plan?	
Did anything unexpected happen?	
Were you pleased with the assessment decision; i.e. was it what you expected?	
How could the process have been carried out more efficiently?	
How could the process of assessing the knowledge be improved?	
How could the Performance Observation checklist be improved?	
Was the evidence you gathered sufficient to make a judgment of competence?	
Was the way you obtained feedback from the learner effective?	
Were you pleased with the way you communicated your decision to the learner? If not, how could this have been improved?	
How would you improve the assessment process?	

Any learner has the right of appeal against any not-yet-competent decision by the assessor. If the learner wishes to appeal, please assist him / her to complete the form below.

Appeal Form			
I hereby appeal against the outcome of my assessment.			
Date:			
Learner's Name:			
Assessors Name:			
Organisation:			
Assessment Details: Criteria, role, standards Used, etc.			
Issue to be Reviewed:			
Learner's Signature		Date:	
Assessor's Signature		Date:	

Step 10

Administration and Completion of Portfolio of Evidence

All the documents or copies thereof, as prescribed previously, must be kept on file as part of the learner portfolio of evidence.

Learner's portfolio of evidence must be readily available for internal and external moderation and verification by the appropriate practitioners, until after the verification process has taken place. The portfolio of evidence may then be kept or returned to the learner according to the service provider's policy.

The prescribed learner results form should be submitted to the ETQA or the National Learner Database as per the SETA procedure.

