NQF Level: 3 **US No:116267**

Assessment Guide

Primary Agriculture

Manage Soil Fertility and Plant Nutrition

Assessor: . . . . . .

Workplace / Company: . . . . . .

Commodity: . . . . . Date: . . . . . .

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Department:
Agriculture
REPUBLIC OF SOUTH AFRICA

AgriSETA

Before we start...

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 relevant Learner Workbook.

Please Note:

This Unit Standard **116267** Assessment Guide must be read in conjunction with the generic Assessor Guide as prescribed and published by the AgriSETA.

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 required during the application of this assessment are available on the website of the AgriSETA and should be strictly adhered to. The assessor must familiarise him/herself with this document before proceeding.

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

Title:	Manage soil fertility and plant nutrition				
US No:	116267	**NQF Level:**	3	**Credits:**	5

This unit standard is one of the building blocks in the qualification listed below. Please mark the qualification you are currently assessing, because that will be determined by the context of application:

Title	ID Number	NQF Level	Credits	Mark
National Certificate in Animal Production	49048	3	120	❒
National Certificate in Plant Production	49052	3	120	❒

Please mark the learning program you are enrolled in:

Are you enrolled in a:	Y	N
Learnership?	❒	❒
Skills Program?	❒	❒
Short Course?	❒	❒

Note to Assessor:

If you are assessing this module as part of a full qualification or learnership, please ensure that you have familiarized yourself with the content of the qualification.

Activity Answers

1

SO 1

Instructions to learner:

Group Activity

Learner Guide: Page 11 **Facilitator Guide: Page 11**

1. Develop and draw a flow diagram of the steps that you would follow when you need to apply a granular fertilizer.

Model Answer(s):

- *Key Steps:*
- *Obtain the instruction as to the type of fertiliser, concentration of the active ingredient and the mass to be applied.*
- *Calculate the mass required to fertilise the mentioned orchard/s*
- *Check the stores for stocks available.*
- *Check the safety regulations required when handling this fertiliser.*
- *Prepare measures for each staff member that will be involved in the actual application of the fertiliser that will scope the required mass.*
- *Supervise the loading of fertilisers to ensure the correct type and number of bags is loaded.*
- *Off-load the bags at appropriate intervals in the orchard.*
- *Demonstrate the correct method of application.*
- *Stress the safety regulations required handling this type of fertiliser.*
- *Supervise the application*
- *Collect and count the empty bags and estimate the mass of fertilisers in opened half-used bags.*
- *Return empty bags to appropriate area.*
- *Return half filled bags of fertilisers to the appropriate area.*
- *Calculate the mass applied and compared to the mass required.*
- *Investigate any discrepancies and report to the manager.*

2. Discuss the following in your group according to the principles below, and you're your own notes

a) Risky conditions that may affect the safety of the staff involved in the process.

Model Answer(s):

- *Inhaling dust, possible irritation of skin and eyes.*

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

Model Answer(s):

- *Scoops not properly filled – Less than was instructed is applied, tress will experience stress resulting in lower production.*
- *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.*
- *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.*
- *Application of the wrong fertiliser – Incorrect type and concentration which could result in over or under supply of the nutrient with resulting poor yields.*

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

Model Answer(s):

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

Supervise a fellow learner whilst he/she demonstrate the calibration of the fertiliser application equipment used commonly at your place of work

Model Answer(s):

None provided – should be according to site specific procedures and industry guidelines

Activity Answers

2

SO 1

Instructions to learner:

Case Study

Learner Guide: Page 19 **Facilitator Guide: Page 11**

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 beaconed 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.

Answer the questions below:

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

Model Answer(s):

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

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

Model Answer(s):

- *Identified area where problems occurred.*
- *Determined plant part indicating possible deficiency.*
- *Identified symptoms of deficiency.*
- *Identified deficiency.*
- *Identified cause of deficiency*

3. What would you have done differently?

Model Answer(s):

- *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.*

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

Model Answer(s):

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.

My Notes ...

Activity Answers

3

SO 1

Instructions to learner:

Questions

Learner Guide: Page 19? Facilitator Guide: Page 11

Complete the questions below.

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

Model Answer(s):

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

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

Model Answer(s):

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

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

Model Answer(s):

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

Activity Answers

4

SO 2

Instructions to learner:

Group Activity

Learner Guide: Page 22 Facilitator Guide: Page 13

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.

1. What do you think the steps for each stage of sampling should be?
2. List the steps that you believe should be taken when taking leaf and soil samples.
3. Next to each step, write down who would normally do it on a citrus farm.
4. Write down the safety instructions that you would have to give to your team for each specific step.
5. 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.
6. After finalizing the group discussion and deciding on the best options write them down in the sheet below and make key notes for your self.

Model Answer(s):

Step	*Responsible Person*	*Safety Instructions*	*Cautionary Information*
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:			
Correct leaf *Sub-samples for soil* *Tie the bag air tight for leaves* *Keep samples cool.*			

Activity Answers

5

SO 2

Instructions to learner:

Questions

Learner Guide: Page 26? Facilitator Guide: Page 13

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

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

Model Answer(s):

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

2. What could happen if no records were kept of samples?

Model Answer(s):

- *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.*

3. Supervise one of your fellow learners whilst they implement the soil sampling procedures (including labeling and dispatch), for fertilization recommendation analyses, that are practiced at your place of work.

Model Answer(s):

No model answer provided – site and industry specific procedures and guidelines to be followed.

Activity Answers

6

SO 3

Instructions to learner:

Questions

Learner Guide: Page 38 Facilitator Guide: Page 14

Complete the questions below.

1. What will the result be of too high concentrations of the following elements on the quality of citrus fruit? : Nitrogen, Phosphorus, Potassium.

Model Answer(s):

♦ *Nitrogen*	♦ *Reduction is 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 is sugars levels* ♦ *Increase in acid content* ♦ *Course skins* ♦ *Less juice* ♦ *Thicker skins* ♦ *Too many too large fruit*

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

Model Answer(s):

♦ *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 Answers

7

SO 4

Instructions to learner:

Group Brainstorm

Learner Guide: Page 40 **Facilitator Guide: Page 16**

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

1. What are the physical soil properties?

Model Answer(s):

- *Texture.*
- *Structure.*
- *Layering.*
- *Soil depth.*
- *Aeration*

2. What are the chemical soil properties?

Model Answer(s):

- *pH.*
- *Resistance.*
- *Organic material.*
- *Salinity.*
- *Fertility.*

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

Model Answer(s):

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

4. 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?

Model Answer(s):

- *When the pH of the soil is either too low or too high, the solubility of the nutrients is 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*

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

Model Answer(s):

- *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.*

My Notes ...

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Activity Answers

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SO 4

Instructions to learner:

Questions

Learner Guide: Page 44 **Facilitator Guide: Page 16**

Complete the questions below.

Give reasons why the following physical and chemical properties of soils will impact on plant nutrition: Physical Properties – Texture, Structure, Soil Layering, Soil Depth, Aeration; Chemical Properties – PH, Resistance, Salinity, Organic Material, Fertility.

Model Answer(s):

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 many 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 Answers

9

SO 4

Instructions to learner:

Questions

Learner Guide: Page 48 Facilitator Guide: Page 16

Complete the questions below.

1. Describe the positioning of a profile pit.

Model Answer(s):

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

2. Describe the major components of a soil profile.

Model Answer(s):

- *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 is used to characterise 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.*

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

Model Answer(s):

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 Answers

10

SO 5

Instructions to learner:

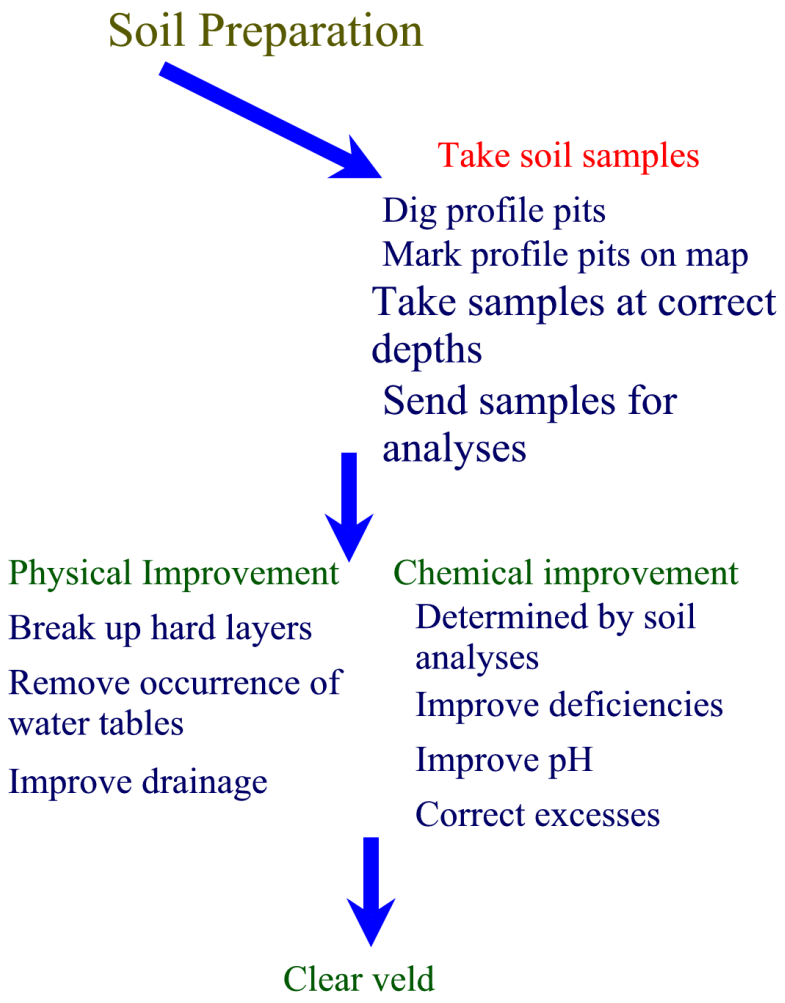
Group Activity

Learner Guide: Page 50 Facilitator Guide: Page 18

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



Discuss the questions below in your group and complete.

1. What are the different methods of soil preparation?

Model Answer(s):

- *Loosening without mixing.*
- *Loosening by mixing.*
- *Ridging*

2. What do you know about mechanical soil preparation?

Model Answer(s):

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.

3. What do you know about non-mechanical soil preparation?

Model Answer(s):

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

Activity Answers

11

SO 5

Instructions to learner:

Questions

Learner Guide: Page 57 Facilitator Guide: Page 18

Complete the questions below.

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

Model Answer(s):

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

2. How will layering restrict root development?

Model Answer(s):

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.

My Notes ...

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Summative Test and Attitude & Attribute Evaluation

Before the knowledge test 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, the **Preparation for Your Final Assessment** section in the learner workbook. Learners and assessor should sign off this section to acknowledge that this step was completed.

Please set up a knowledge test from the questions given as a guideline to learners and supply each learner with a test sheet.

Supply each report with the following heading:

Unit Standard:	116267	**NQF Level:**	3
Learner Name:			

Questions	Model Answers
1. Explain how you would mix fertilizer 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.*
2. Explain how you would mix fertilizer to apply through: Foliar application	• *Two principles are involved:* • *The chemistry of the different products must be compatible. Do not mix calcium with sulphates or zinc nitrate with a product with an alkaline pH.* • *The correct time of application of each product must be the same.*

Questions	Model Answers
3. 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.*
4. Make a list of equipment that would need to be calibrated during the fertilization 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*
5. 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.*
6. Do you think that a general farm worker is involved in the calibration of fertilization 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.*
7. 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 liters of water."	• *As per learner's own perspective.*
8. In your own words, describe why you think it would be important to take samples of each of the following: Leaves, Soil.	• *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.*

Questions	Model Answers
9. Explain whose duty the taking of the following samples would be on a citrus farm: Leaves, Soil.	• *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.*
10. 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.*
11. 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.*
12. 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.*

Questions	Model Answers
13. 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.*
14. 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 cations exchange capacity.*
15. 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 Cal).*
16. What would happen if: You applied a foliar spray with a mist blower on a windy day? ; You applied a too strong fertilizer mix to your orchard? ; You forgot to fertilize as per recommendations?	• *The material will drift to other areas and the foliar spray will dry-out too quickly and be less effective.* • *An over supply of fertilizers (too strong fertilizer 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 (fertilizers) remain in the root zone. The imbalances will suppress the uptake of other ions creating deficiencies and loss of crop.* • *Nutrient deficiencies will occur, with the symptoms depending on the type of fertilizer that was not applied. The first effect will be a decrease in yield and/or fruit size followed by quality problems.*
17. What would be your recommendation for soil preparation if: There is a very hard rock layer approximately 30cm under the topsoil.; There is a distinct colour difference between soil horizons at a depth of 60cm.	• *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.* • *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.*
18. What would be the visible defect in a citrus tree if there was too little of the following macro nutrient element available: Nitrogen, Phosphorous, Potassium.	• *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 canters 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.*

Questions	Model Answers
Calcium	• *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.*
19. What would be the visible defect in a citrus tree if there were too little of the following micro nutrient element available: Boron, Zinc, Iron, Manganese,	• *Boron: The most detectable symptom is smaller fruit with gumming in the albido. 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 leafs of normal size.*
20. 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.*
21. 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 cations holding capacity.*
22. Do you think that adding fertilizer 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.*
23. 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.*
24. 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.*

Questions	Model Answers
25. 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.*
26. 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.*
27. 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.*
28. 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.*
29. 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.*
30. 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.*

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:**