NQF Level: **4** US No: **116316**

Learner Guide

Primary Agriculture

Plant Propagation

My name: . . . .

Company: . . . .

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

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agriculture
Department: Agriculture
REPUBLIC OF SOUTH AFRICA

AgriSETA

Before we start…

Dear Learner - This Learner Guide contains all the information to acquire all the knowledge and skills leading to the unit standard:

Title:	Propagate plants in a variety of situations		
US No:	**116316**	**NQF Level:** 4	**Credits:** 3

The full unit standard will be handed to you by your facilitator. Please read the unit standard at your own time. Whilst reading the unit standard, make a note of your questions and aspects that you do not understand, and discuss it with your facilitator.

This unit standard is one of the building blocks in the qualifications listed below. Please mark the qualification you are currently doing:

Title	ID Number	NQF Level	Credits	Mark
National Certificate in Animal Production	48979	4	120	❒
National Certificate in Plant Production	49009	4	120	❒

Please mark the learning program you are enrolled in:

Your facilitator should explain the above concepts to you.

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

This Learner Guide contains all the information, and more, as well as the activities that you will be expected to do during the course of your study. Please keep the activities that you have completed and include it in your **Portfolio of Evidence**. Your PoE will be required during your final assessment.

What is assessment all about?

You will be assessed during the course of your study. This is called *formative assessment*. You will also be assessed on completion of this unit standard. This is called *summative assessment*. Before your assessment, your assessor will discuss the unit standard with you.

Assessment takes place at different intervals of the learning process and includes various activities. Some activities will be done before the commencement of the program whilst others will be done during programme delivery and other after completion of the program.

The assessment experience should be user friendly, transparent and fair. Should you feel that you have been treated unfairly, you have the right to appeal. Please ask your facilitator about the appeals process and make your own notes.

Your activities must be handed in from time to time on request of the facilitator for the following purposes:

- The activities that follow are designed to help you gain the skills, knowledge and attitudes that you need in order to become competent in this learning module.
- It is important that you complete all the activities, as directed in the learner guide and at the time indicated by the facilitator.
- It is important that you ask questions and participate as much as possible in order to play an active roll in reaching competence.
- When you have completed all the activities hand this in to the assessor who will mark it and guide you in areas where additional learning might be required.
- You should not move on to the next step in the assessment process until this step is completed, marked and you have received feedback from the assessor.
- Sources of information to complete these activities should be identified by your facilitator.
- **Please note** that all completed activities, tasks and other items on which you were assessed must be kept in good order as it becomes part of your **Portfolio of Evidence** for final assessment.

Enjoy this learning experience!

How to use this guide ...

Throughout this guide, you will come across certain re-occurring “boxes”. These boxes each represent a certain aspect of the learning process, containing information, which would help you with the identification and understanding of these aspects. The following is a list of these boxes and what they represent:

What does it mean? Each learning field is characterized by unique terms and **definitions** – it is important to know and use these terms and definitions correctly. These terms and definitions are highlighted throughout the guide in this manner.

You will be requested to complete **activities**, which could be group activities, or individual activities. Please remember to complete the activities, as the facilitator will assess it and these will become part of your portfolio of evidence. Activities, whether group or individual activities, will be described in this box.

Examples of certain concepts or principles to help you contextualise them easier, will be shown in this box.

The following box indicates a **summary** of concepts that we have covered, and offers you an opportunity to ask questions to your facilitator if you are still feeling unsure of the concepts listed.

My Notes ...

You can use this box to jot down questions you might have, words that you do not understand, instructions given by the facilitator or explanations given by the facilitator or any other remarks that will help you to understand the work better.

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What are we going to learn?

What will I be able to do?

When you have achieved this unit standard, you will be able to:

- Propagate plants.
- Gain specific knowledge and skills in plant propagation and will be able to operate in a plant production environment implementing sustainable and economically viable production principles.

Learning Outcomes

At the end of this learning module, you must is able to demonstrate a basic knowledge and understanding of:

- Basic safety requirements related to the propagation environment, tools and procedures.
- Basic hygiene requirements for the propagation environments.
- Growing media - wet and dry.
- Weeds, pest and diseases.
- The safe use and handling of a variety of Chemicals and hormonal and other organic preparations.

What do I need to know?

It is expected of the learner attempting this unit standard to demonstrate competence against the unit standard:

- NQF 3: Explain the propagation of plants.
- NQF 4: Demonstrate a basic understanding of the physiological processes in plant growth and development.
- NQF 3: Explain the planning and scheduling of tasks in a production environment.
- NQF 3: Interpret and maintain factors influencing agricultural enterprises and plan accordingly.

Session 1 Propagate a variety of plant types

After completing this session, you should be able to:
SO 2: Propagate a variety of plant types using different methods.

In this session we explore the following concepts:

- Asexual propagation

1.1 Introduction

Asexual propagation implies the use of vegetative plant parts to generate another plant which is true-to-type of the mother plant. Pure lines of a crop can be reproduced using asexual propagation. The choice of the specific method used depends on the ease with which one can perform the operation, the associated costs and the final value of the crop and potential yields.

1.2 Methods of Asexual Propagation

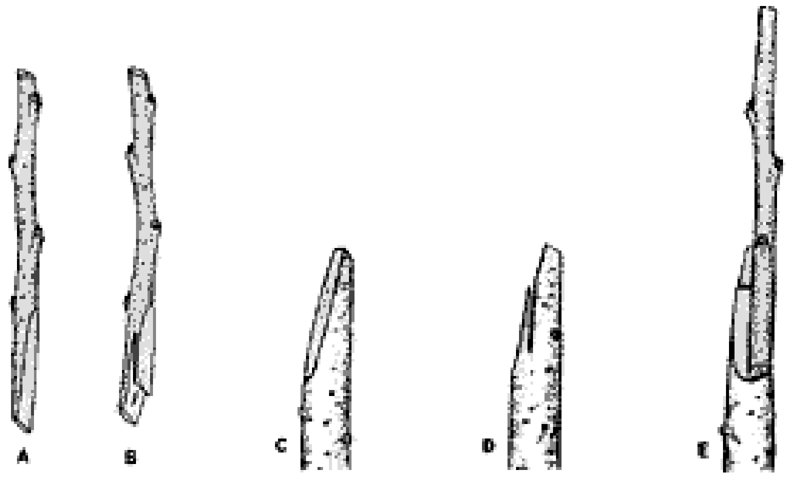
The choice of propagation method depends on the expected final product. The propagator has to work towards achieving what the grower desires. If desirable traits are lost or changed by a propagation technique, the method used is unsatisfactory. Successful methods transmit all the desirable traits of the mother plant.

Crops are propagated asexually using the following:

- Grafting
- Budding
- Cuttings
- Layering
- Tissue culture

Grafting

- Whip grafts

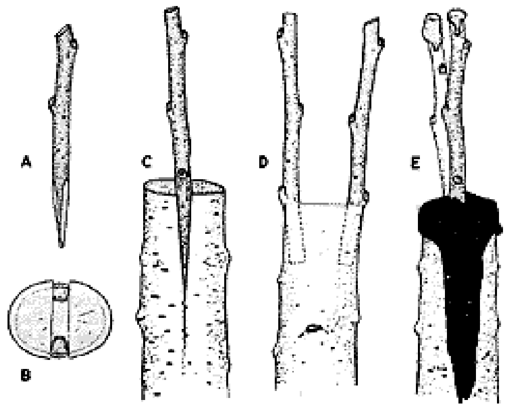


Cut off a branch of the root-stock leaving a stub of about 30 cm in length. Now make a straight, slanting cut about 4 cm long on both the scion and the stalk (A and C). Ensure the cut is straight and even using a single stroke with a sharp knife.

Next, cut the tongue by making a straight draw cut beginning near the top and cutting about the full length of the level (B and D); ensure you do not split the wood. To unite, match the two parts together (E). Ensure that the scion is in contact with the inner bark on one side. Finally bind tightly with tape and then carefully cover the union and binding material with grafting compound.

Remove the wrapping material as soon as the scion has started to grow.

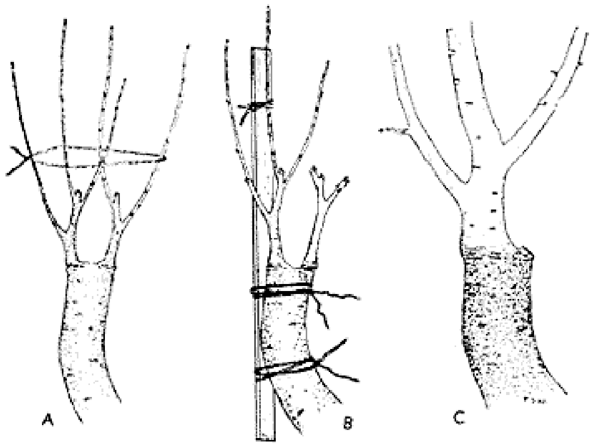
- Cleft Grafts



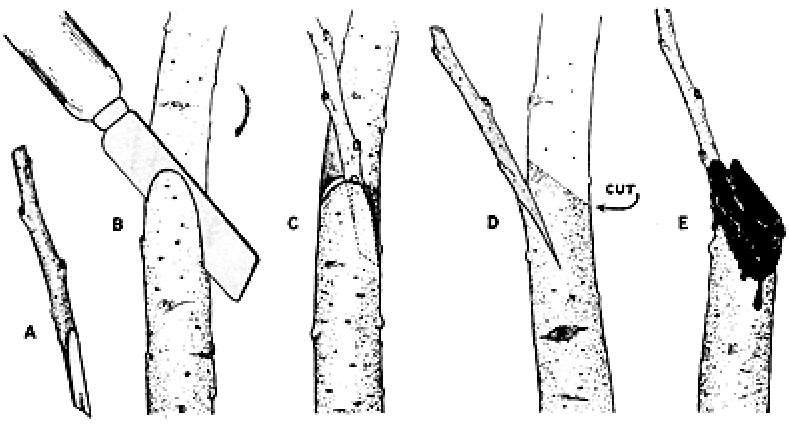
First select an area on the tree that is free from knots and cut off the stalk with a saw. Now use a large knife or hatchet to make a gap into the wood but avoid the wood from splitting. Cut the scions to include three buds. Make this cut as a sloping cut about 1 cm above the upper bud. Cut the scions to a blunt wedge about 3 cm in length with one side slightly thicker than the other (A and B).

Open the gap slightly with a grafting tool or screwdriver and insert a scion on each side, with the inner bark of stalk and scion making contact and the thick side of the scion outward (B). A slight tilt will ensure good contact (D). Cover the unions with grafting compound ensuring the cleft is covered its full length (E).

Scions that are growing vigorously will need attention to prevent breakage by birds etc... You can tie the scion to a supporting brace or pinch back the tips before growth becomes excessive. For additional support, circle all the shoots from one stub with twine.



- Side Grafts



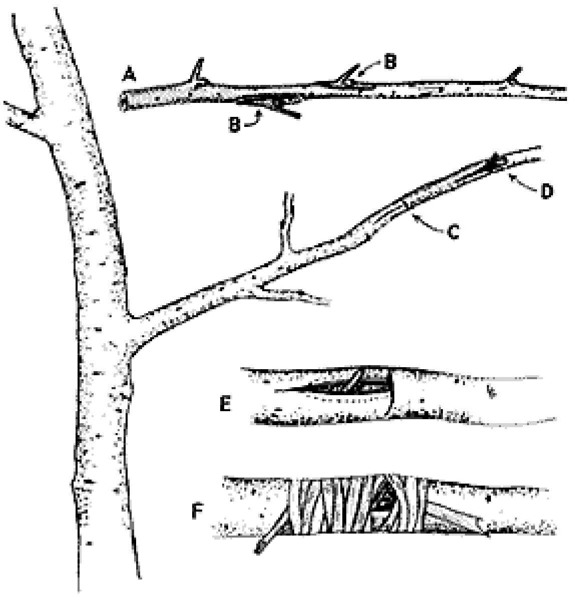
Select a smooth area on the root stalk branch at least 30 cm from the trunk. Make a slanting cut at a narrow angle almost to the core of the branch (B). Cut the scion to a short, sharp wedge about 3 cm in length with one side thicker than the other (A). Now bend the branch slightly to open the cut. Press the wedged scion into the branch's slanting cut so that the cambium layers of the stalk and scion meet at one side (C). Cover the cut surfaces with grafting compound (E).

After two weeks, cut off the stalk above the union (D) using sharp shears in order to avoid disturbing the scion. Again cover the cut surface with grafting compound (D).

Budding

- T-cut buds

Budding is a form of grafting in which a single bud is used as the scion rather than a section of stem. It is the most commonly used method for fruit tree production in the nursery. Budding is done in the summer when the bark of the stalk slips easily and when there are well-grown buds. The first step is to cut bud sticks of the desired cultivar from strong shoots of the present season's growth (A). Clip off the leaves as soon as the bud sticks are cut, leaving about 1 cm of the leafstalk as a handle. Now make a T cut across the bark on the branches of the stalk, about 30 cm or more from the trunk (C). Now, with a knife blade or bark separator, lift the corners and carefully loosen the bark.



Cut a bud from the bud stick (A) which includes a thin piece of attached wood (B). Start by pushing the bud under the loosened flaps of bark and push it right down to the end of the T-cut (D and E). Use tape to tie the bud tightly and wrap the tie, but do not cover the bud (F).

Cut the ties within two or three weeks. Cut on the side away from the bud. Rubber strips need not be cut. The bud should remain dormant until the following spring.

- Chip Budding

  Chip budding is a grafting method used in a tree crop propagation. The technique is applied when the bark does not slip freely. This method requires more skill than the requirements for the inverted T-cut.

  To cut the chip bud, it is held with the apical end toward the propagator. A thin section of wood containing a selected scion bud is removed by making a smooth upward cut only just into the wood. A second cut is made into the prepared shoot at the upper end of the first cut, forming a notch.

  A chip is removed from the stem of the rootstock which is to receive the new cultivar bud. Because only two thin sections of cambial tissue are available for the joining process on the scion bud and the rootstock, it is important that these are matched whenever possible. Once joined the scion should be wrapped using a similar method as used described for inverted T-buds.

  Once the wrapping has been removed and the union has healed, the bud must be forced to grow as described for inverted T-cut budding.

Cuttings

Cuttings refers to when plant material, more specifically a stem with at least two leaves, with desirable traits is selected and propagated to become a separate pure line individual. They are propagated in greenhouses under conditions of high humidity levels and high light intensity during the day.

Cuttings provide a more rapid method of obtaining rootstock material when there is a shortage of seeds, as well as in the case of certain rootstock varieties, such as Yuma citrange, with a low percentage of nucellar seedlings and a high percentage of off-types.

Propagating a commercial cultivar by means of cuttings has a number of disadvantages, such as vulnerability to soil borne fungi, less adaptability to different soil types and excessive tree vigour.

The following procedure is used:

- The selection and cut is made when active growth has slowed down and the plant has accumulated a high level of stored carbohydrates;

- The cut is made at the bud (node) where the cambium is more active than at the internodes. In the case of rootstock cuttings, simply take the whole upper part section of the budding point and cut it as desired.
- The cutting must be planted within 30 minutes from the first cut. Since the field\orchard (from which cuttings is selected) is generally not close to the greenhouse where cuttings are to be rooted, the cuttings have to be stored under cool circumstances, such as in a cooler-bag to reduce the transpiration rate and moisture-loss while in transit and during subsequent handling.
- Once in the rooting area, the leaves are trimmed back, leaving less than half of its normal surface area.
- The whole cutting is soaked in a suitable fungicide mixture for at least five minutes.
- The cutting is allowed to dry slightly and the lower end is dipped in a growth hormone such as IBA (Indolebutyric Acid or Seradix B).
- The propagator must ensure that the cutting is not wet when it is dipped in IBA.
- The cutting is planted in a sterilised, moist medium which must be able to allow draining of excess water and also porous enough to allow gas exchange. Ordinary composted pine bark (12mm) can be used as a medium.

After planting the cuttings into the cavities or plugs, the wounded surfaces have to heal quickly to prevent the losing of moisture as these increases the chances of rot-inducing agents invading the cutting's tissue.

Healing takes place when a layer of suberin, tannin and other compounds are manufactured Callusing takes place when. These in turn produce an elastic substance that prevents water from escaping and pathogens from entering. The cambium callus develops into a growth point that becomes adventitious roots.

The rooting rate is influenced by the stem-to-leaf ratio as this affects the rate of transpiration. Transpiration rate should preferably be low and the leaves therefore have to be trimmed and kept cool to obtain turgid cells.

Maintaining high humidity and high light intensity is essential for rooting the cuttings. A fog- or a mist unit will do, but the structure must be able to provide additional heat units or heating if required, as the soil or rooting medium requires a temperature in the region of 25°C.

The water holding capacity of the medium must be taken into account. Excessive water supply, or a water-saturated medium, can lead to reduced levels of O_2 and root formation. The medium must allow excessive water to drain freely.

However, this run-off water will take with it most nutrients found in the soil solution. Therefore the plant's conditions must be monitored regularly and corrected if need be with foliar feeds. During this correcting operation the fog application or misting frequency has to be reduced.

With developed roots and active shoots, the cutting grows to a plant that can be transplanted after five to six weeks. The hardening off process imply the gradual reduction of humidity and fog or mist until the plants no longer requires moisture on the leaves to prevent wilting.

- **Layering**

Layering is another method that can be used to propagate citrus. Here, roots are induced to develop from stems while these are still attached to the tree. The rooted stems are then cut and placed in containers or directly into the ground as trees. This method is used on bigger branches mainly. Commercially, this method is not an option as trees produced in this manner don't have the advantages that rootstalks offer.

- **Tissue culture**

This latest and most technical method of vegetative propagation involves a process of cloning. Any plant tissue with cells that can divide can be used for tissue culture. A specialised nutrient medium is prepared in an agar solution which is placed in a flask and sterilized.

The sections of tissue are cut and placed on the surface of the medium. The flasks are closed and kept in a controlled environment. Within a short period of time the callus develops which is cut into smaller sections and divided. Eventually a new plant develops which is hardened off and used in the field. This method is widely used in the strawberry industry. However, highly specialized equipment and facilities are required and therefore this method is rarely used on farm.

Tissue culture is used readily with species such as grapes, strawberries, asparagus, and carrots, as well as on flower crops such as orchids, chrysanthemums, gladiolus and gloxinia.

This procedure is also used in tree crops, such as citrus. With other species, especially long-lived perennials, such procedures are very difficult. The costs associated with tissue culture are high and therefore the crop should be of significant value before considering the use of this technique. The technique requires specialised equipment, expertise and laboratories.

1.3 Methods of Asexual Propagation in Relation to Plants Types

Different types of plants are propagated using different methods and different plant sections, as follows:

- **Strawberry** plants are propagated using its aerial stem, referred to as runner. This is the main used in commercial propagation of strawberries. A section of the runner is cut and rooted to reproduce another plant.
- Plants of the **lily** family are propagated using the bulb, which is a shortened stem with thick and fleshy leaves. Individual bulbs are allowed to generate roots and develop to plants. Onions are part of this category.
- **Bananas** propagate by means of offshoots, which are lateral shoots developing from the stem, also referred to as suckers. In the commercial propagation of bananas, suitable offshoots are carefully dug up from the base of vigorous, well developed plants and planted out in the fruiting plantation.
- **Litchis** are propagated through air layering, which is the regeneration from vegetative part while still attached to the plant.
- **Grape-vines** are propagated through cuttings and in some cases using tissue culture which is a method that differs from layering by the fact that the vegetative part being regenerated is detached from the plant.

Plants in all these categories are commercially reproduced through tissue culture.

1.4 Use of hormones for Asexual Propagation

Hormones are chemical treatments that primarily induce root production and development and healing wounds on the plant. Hormone treatments are used in tree crop propagation primarily for rooting of cuttings.

Naturally, hormones are produced within the plant in low concentrations and are transported to other locations within the plant where they are required.

The auxins responsible for growth stimulation such as in adventitious root initiation have been identified as Indole-3-acetic acid (IAA. These hormones however occur naturally at very low concentration and the site of production is removed from the site of action, it thus is likely that a cutting will not contain sufficient hormone to induce rooting.

Parallel to the identification of IAA, it was established that the synthetic products Indole butyic acid (IBA) and Nephtaleneacetic acid (NAA) are effective in initiating adventitious roots and root development. During propagation through cuttings the auxin initiates the transformation of callus into root primordial tissue which will later become the roots.

Other hormones such as cytokinins and gibberelin are used to aid in cell growth and differentiation as well as stem elongation respectively. In many crops such as citrus these hormones are produced naturally in sufficient quantities to stimulate physiological reactions and are not used in this crop.

1.5 Sanitary Measures in Propagation Procedures

Sanitation during propagation is of the utmost importance to ensure industries continuous development. Within most industries there are likely to exist a series of regulations or procedures for the propagation systems.

The first line of defence against contamination is to isolate or strictly control access to the propagation area. Personnel that have access to propagation areas have to be provided with procedures on preventing contamination.

All tools used must be dedicated to the specific areas and operations of propagation, and should not be interchanged between different zones. Propagation tools must be disinfected on regularly, and stored in a clean, dry area.

ACTIVITY

Please complete Activity **1.**
Investigate and record
Research the various propagation methods used for asexual propagation of the crop grown at your place of work. Make use of internet searches or literature on the subject to gain the information.

1. Write a short report the various methods used.

- Can this method be used for other crops?
- If yes what are these crops?
- Will the methods have to be modified at all to be applied to other crops?

Now determine the reasons why the method currently being used at your place of employment was selected (not necessarily by the learner), but by site management?
Answer the following:

2. Are there any specific reasons why the method, currently in use, was selected?
3. Are there alternatives that can be used that may be more effective or more cost effective?
4. Determine and describe the best practice for this particular method.
5. Are the principals of the best practices, as determined by you, applied at your place of work?
6. If not, what are the shortcomings on farm/place of work?

ACTIVITY

Please complete Activity **2.**

Investigate and record

Discuss and demonstrate the various types of budding and grafting methods that are generally used in your industry

ACTIVITY

Please complete Activity **3.**

Investigate and record

1. Why are hormones used in the propagation of the crops grown at your site of work?

2. What hormones are used?

3. Are there procedures in place that describe how the hormones are to be applied?

4. Describe and demonstrate how the hormones are mixed, applied and stored, following the site specific procedures.

ACTIVITY

Please complete Activity **4.**

Investigate and record

1. Identify the sanitary procedures that must be followed on the farm when a crop is propagated at you place of work.

2. Develop a relevant Standard Operating procedure for the application of relevant sanitary procedures for the propagation process followed.

3. Compare the newly developed Sop with the current Sop implemented at your place of work

My Notes …

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How am I doing?

Concept (SO 2)	I understand this concept	Questions that I still would like to ask
The different methods of asexual propagation are identified and applied and best practice is selected.		
The different methods of asexual propagation in relation to the types of plants are explained.		
The different types of budding and grafting methods are applied and explained.		
The use of hormones for asexual propagation is described.		
Methods to guide a team to use the correct sanitary measurements in propagation procedures are applied.		

My Notes ...

Session 2 Recognise and use propagation structures

After completing this session, you should be able to:
SO 1: Recognise and use propagation structures, facilities and materials under supervision and do problem solving on his / her own in relation to processes and maintenance.

In this session we explore the following concepts:

- ♦ Propagation structures

2.1 Introduction

The propagation of crops is a natural process that is undertaken under modified and controlled environments in order to enhance this natural process. These environments are modified to ensure the optimum growth of the crop in question. Propagation structures are established to create environments that can be modified and controlled.

2.2 Propagation Structures

In general, propagation is done in various structures including:

- Germination rooms
- Greenhouses
- Shade-houses
- Specialised tissue culture laboratories

Germination rooms

During the propagation of tree crops, the rootstocks are usually propagated from seed. Seed trays that have been sown with rootstock seed are kept in germination rooms where they remain until the seedlings have developed and are ready to be transplanted into seedling trays.

Germination rooms are usually permanent buildings, with constructed walls that are plastered and painted. The standard size for a germination room is 3m x 2m with a ceiling height of 2.5m. A germination room is developed in a way to retain as much heat as possible with limited air-circulation and the potential for build-up of humidity.

The rooms are generally equipped with fluorescent lights as a source of red light, which promotes germination.

Green houses

Most greenhouse structures are manufactured from either shade cloth (shade houses) or plastics sheeting.

- Shade houses

  Shade houses are green houses made from shade cloth. It is the cheapest system available and is easy to construct. Shade cloth provides protection against sun, wind, hail and rain. The shade cloth does not absorb water and does not decay as easily as plastics sheeting. Shade cloth allows wind to circulate into green houses, assisting in cooling of the construction. It will provide protection against animals, large insects and birds but will not protect it against small insects. Temperature and humidity cannot be regulated either.

Plants grown under shade cloth are reasonably protected from harsh environmental conditions. Aeration is passive as the wind speed is reduced. The main concern is the transpiration rate. With extreme light-intensity, the temperature in the shade-house increases and the relative humidity decreases. Keeping cells turgid becomes the main goal. The choice of shading percentage is influenced by this goal. The ultimate is an environment where light-intensity is reduced, which in turn reduces the temperature and increases humidity.

All shade-houses are equipped with irrigation and fertilisation systems with fixed access points for pest and diseases control systems.

Young Citrus Trees in a Shade-house

- Shade netting

  Shade netting is produced from knitted polyethylene cloth. The product is available in green, black and white and has density ranges from 20 to 90 %.

The density indicates the percentage Ultra violet light that is absorbed by the netting. Shade-cloth is available in different colours and shading percentages.

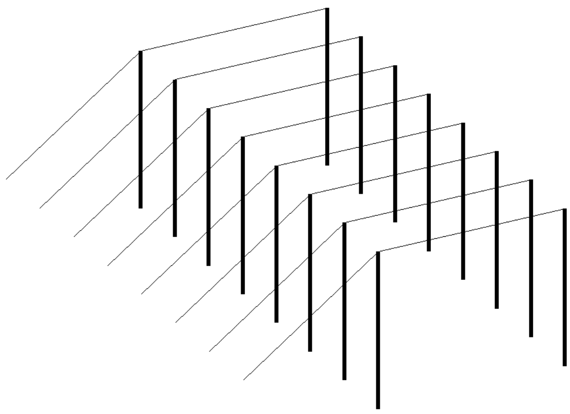
The most commonly used in the South African citrus industry are black and white nets. Depending on the area, the percentage of shading varies between 30% and 60%. In the flower industry a pink net with 40% density netting is used to stimulate flowering.

- Types of shade houses

Shade houses are constructed either as flat roofed or pitched roofed shade houses.

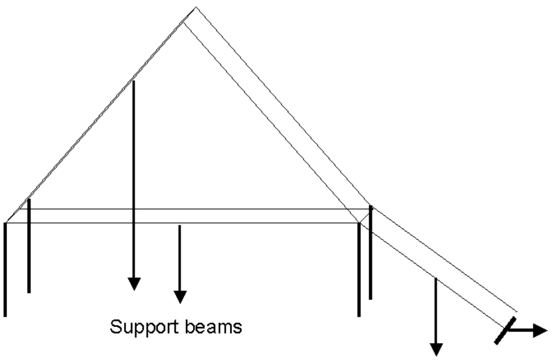
- Flat roof shade houses

Flat roof shade houses are used in areas where low or no hail is expected. They are easy to construct and cheaper than pitched roof constructions. The construction is laid out so that plant rows are north – south orientated. The areas for one flat roof shade house should not exceed 100 X 100 m. The area is measure off and divided into sub-blocks each 3 X 6m or 6 X 6m. This is the spacing at which the carrier poles will be planted. Poles are planted 0.5 to 0.9 m deep in the ground. The height of poles dependent on the structure required. The poles used are usually treated gum poles. The perimeter poles are anchored by using steel cable or wire. The anchor-wire is anchored to a stay or a specialised anchor which is driven into the ground before the anchor wire is secured. Stay wires are pulled across the top of the planted poles and the shade netting secured on top of the wire grid that is created. The netting is secured to perimeter poles using high tensile steel wire or cable pre-fitted through the eyelets in the netting. The netting is now fasted to the cross wires at 1-m intervals.



- Pitched roof shade houses

  Pitched roof structures are suitable for areas where hail is prominent. The construction uses more materials and longer poles than a flat structure and is therefore more costly to build.



  The standard height for construction poles are 4.2 m and 2.6 m. The shorter poles are planted at 2m intervals on the outsides of the structure. The longer poles are planted on the other side and netting secured over the construction.

♦ Plastic clad greenhouses or tunnels

  Plastic clad greenhouses and tunnels consist of pole structures covered with specialised plastics cladding.

  The advantages of plastics tunnels include:

- The tunnel can be sealed, aiding in proper climate control.
- Crops are not damaged by environmental conditions.
- Use is not limited by season.

  The disadvantages include:

- Plastics sheeting has a limited life-span
- Construction cost are high
- Temperature control units must be installed especially to control extreme variations in temperatures.

Tunnels are constructed as a series of sequential metal arches, which are covered with plastic sheeting. The system is usually fitted with a door and cooling system. The sizes of the tunnels differ, depending on the manufacturer or supplier.

Selection of Green house type

The materials used to build a greenhouse depend on the environment in which the structure will be built as well as the environmental requirements of the plants. If the greenhouse is to be built in a location that is known to be windy, provision must be made to strengthen the structure to withstand wind. If the structure is to be built in conditions that are generally humid, special corrosion-resistant material must be used. At the same time, the design and material used in the greenhouse must contribute in creating the ideal environmental conditions that promote plant growth.

Greenhouses generally have a metal framework (aluminium or galvanised steel or stainless steel) that is rust- and corrosion resistant. The framework is clad with ultraviolet (UV) resistant polyethylene sheeting. Initially glass was (and still is) used to cover the metal framework, but it is very expensive. A variety of different plastics cladding can be used, but the best results in terms of lifespan and light penetration, have been obtained with 100 micron UV resistant cross-woven polyethylene sheets.

Greenhouses provide a more favourable environment than the outdoors. The propagator is not at the mercy of nature's extremes in as far as temperature is concerned and propagation and plant production can take place year-round. If environmental control systems are installed, temperature is controlled to allow normal respiration, even when photosynthesis is reduced as is commonly found when cloudy weather prevails.

Humidity ensures that the environment is cooled. This reduces the respiration rate resulting in fewer carbohydrates being used (burnt) for respiration and thus more being available for plant growth. Greenhouses are equipped to humidify the air when required.

The following environmental control equipment may be installed:

- A wet-wall is constructed by using a honey combed cellulose pad, a distribution pad, perforated PVC pipes that provide the water that run through the wall, a pump and a shallow tank – used for cooling;
- A set of extractor fans, or exhaust fans, that draw cooled and humidified air through the greenhouse;
- An irrigation system for irrigating the plants;
- An automated control system that regulates the light intensity or day length through curtains or supplementary light.

Air movement also helps to avoid injurious levels of temperature and CO^2. The propagator must constantly check the balance between heat build-up and the availability of CO^2 for plant growth.

Seedlings in a Greenhouse

2.3 Potential Problems with Structures

Structures are used to provide an environment that is and remains easily controllable. Should any structure lose this property, it becomes less useful to the propagator and economic losses may occur.

Potential faults may occur with the control devices, such as probe malfunction, the wrong interpretation of information that has been relayed by the instrument or the structural frame itself.

Propagation structures are generally held together with links and joints which can loosen. Therefore, links, joints and the generally stability of the structure must be checked regularly.

Cracks or cuts in the covering material, whether it is the polyethylene sheeting or shade-cloth, results in unwanted changes of the environmental conditions within the structure. Plants are exposed to harsher conditions with an increased probability of damage to the plants.

Greenhouses are at greater risk. Fans and wet-wall malfunctions have disastrous implications. Temperatures can quickly reach levels where plants cannot continue normal metabolic processes, resulting in severely wilted plants which are the result of low photosynthesis rate. Poor aeration can lead to a drop in the CO_2 level, limiting photosynthesis. High respiration rates are required with a constant supply of O_2 and CO_2.

The selection of the wrong covering material for a shade-house can result in poor light intensity during a specific time of the year. Light is filtered before reaching the plants. The location and season are important factors that determine the quantity of light received. Light intensity is generally high from October to March, peaking in January. During April to September, the light intensity is moderate with lowest being recorded in June (21st).

2.4 Propagation Media

Different media are available for citrus propagation, ranging from natural coarse river sand to exfoliated vermiculite. The choice of the medium is determined by the propagation method and the economics of the specific propagation.

The success or failure of a propagation activity can be influenced by a medium used and how this medium is handled. The quality of the materials used to formulate propagation media is very important. The materials must be consistent in quality, free from pathogens and must provide an appropriate balance between air and water in the medium.

In any growth medium, the space not occupied by solids, constitutes pore space which is utilised partially for holding water and partially to provide air for the plant roots to function normally. An absence of either may be injurious to the plant.

Oxygen is essential to healthy root activity and it is important that it is available in sufficient volumes. After saturating a growing medium with water and after drainage has ceased, there will be a portion of the pore-space occupied by air. In field soils and sand seedbeds, values of 5% or more are usually considered favourable. In containers values of 15% to 25% are desirable, but this may differ for different crops. In the case of citrus for example, media with porosity ranging from 14% to 20% are used.

The higher the total porosity of the growing medium, the greater is its potential to provide water and air. The smaller the pores, the greater the water retention and the lower the air supply. Conversely, the larger the pores, the less water retained and the greater the amount of air space in the mixture.

The quantity of water held in a growing medium is best measured on a volume percentage basis and expressed as water holding capacity (WHC). Different media have different WHC. Sand has larger pores and lower WHC, vermiculite generally has a higher WHC, but the coarser the particle size which depends on the grade, the less water is retained.

A commonly used medium in the South African is sterilised composted pine bark. This medium is used in containers for cuttings and for air layering. Seed are generally germinated in medium grade vermiculite. Most root development occurs in pine bark. Shredded coconut fibre can also be used as an option, but it is more widely applied in the flower industry. Other media include peat moss, sedge peat, composted sawdust, Perlite and rock wool.

The most economic way of sterilising growth media is using steam sterilisation. The bark is treated with hot steam, produced by boiling water. Steam is produced by using a steam generator that is pumped into the medium, usually from the bottom of a container containing the medium.

The temperature in the medium, while being treated, must be raised to 90°C. Steam sterilisation is effective and inexpensive compared to chemical treatments, such as Methyl bromide applications.

Facility Used for Sterilising Pine Bark

2.5 Growing Media Mixes

Different propagators in different areas make use of different growth mixtures to produce the ideal mixture for their particular purpose. In Australia, for instance, propagators frequently use mixtures of peat and sand in a ratio of 3 parts peat to 1 part sand. In Egypt, mixes containing sawdust in a ratio of 1 part sand to 1 part sawdust to 1 part peat are used.

Sand is too heavy for use in small cell trays and tends to fall through the drainage holes. Therefore users tend to use lightweight materials such as Perlite and vermiculite. When propagation is done by means of cuttings, ideal media have maximum porosity and minimum WHC.

Please complete Activity **5:**

Investigate and record

At your place of work determine and record the following for the specific crop that is grown:

1. The propagation methods that are used at your place of work.
2. What kind of cladding has been used and why?
3. What are the major propagation activities that are conducted in the facility?
4. What are the environmental requirements?

Please complete Activity **6:**

Investigate and record

Visit the propagation area that you work at. Make a detailed inspection of the site. Take notes on the aspects below:

1. Describe the basic layout of the structure
2. Identify major structural defects that may develop or those that may be present or developing
3. Determine how critical these defects may be if incurred or left to develop further.
4. Has any damage already been incurred?
5. Write an inspection report on the findings you have made?
6. If no findings were identified, determine the procedures that are in place to ensure the upkeep of the structure.
7. Develop a set of procedures to ensure that defects do not occur without warning. Develop preventative measures and standard operating procedures that describe the process to be followed. Also develop the necessary forms for completion and traceability that check were actually performed.

ACTIVITY

Please complete Activity **7:**

Conduct experiments with growth media

1. At your place of work a specific growth medium is used for propagating the plants you grow. Identify this medium and determine why this is the medium of preference on the farm.
2. Identify at least 3 alternative to the medium used.
3. In an experiment determine the effects of growth medium type on the propagation of the crop you work with.
4. Suggested Outlay:
   - Preferred medium versus at least 3 alternative commercial media.
   - Follow standard propagation procedures as is normal for the crop
   - Ensure that the propagation is conducted within the same propagation structure
   - Allow the propagation process to progress for the required time as necessary
   - Measure a significant growth factor – specific to the propagation method. This factor to be measured may be root volume or mass, cutting length etc...

ACTIVITY

Please complete Activity **8:**

Investigate and record

Determine the following and write a concise report:

1. What is the composition of the growth medium that is used on farm?
2. How is the medium sterilized?
3. Is the medium purchased as ready to use, or is it mixed on farm?
   - If it is mixed on farm, identify the components
   - Determine the proportion of the components that are mixed
   - Develop a set of SOP's for making up the mixtures and applying the sterilisation technique.
   - Specify volumes, temperatures etc that are critical in ensuring the correct measures have been followed.
4. Now while being audited by your supervisor, use the SOP developed to make up and sterilise the medium used.
5. Your supervisor should evaluate whether according to your SOP the procedure has been correctly completed

How am I doing?

Concept (SO 1)	I understand this concept	Questions that I still would like to ask
The propagation structures available for the propagation of plant material for different production systems are identified and evaluated.		
Potential faults of the structures and describe the effect on the success or failure of propagation material are identified.		
The effect of different propagation media on the success or failure of propagation material is described.		
Growing media components are properly measured mixed in form of composition and sterilised.		

My Notes …

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Session 3 Types of propagation media and environments

After completing this session, you should be able to:
SO 3: Experiment with different types of propagation media and environments

In this session we explore the following concepts:

- Artificial propagation

3.1 Introduction

The term propagation medium refers to more than a single standard growth medium. There are several combinations of materials used to host plants in containers or seedbeds. Depending on the needs, the propagator identifies the product best suited to his / her environment to produce the best propagules possible.

3.2 The Role of Artificial Propagation Media

Propagation media are a major component of a propagation operation as they host the roots that feed and stabilise the plant. Most media are invented to meet specific requirements and can therefore be considered (to a certain extent) as artificial, as opposed to natural.

In order for a plant to feed easily, the medium must retain and make available enough water and nutrients. Technically the ability of a medium to retain nutrients is referred to as the cation exchange capacity (CEC) of the medium. Media that are dense, with small pores, inhibit water movement and make it more difficult for the plant to take up nutrients. The other extreme, is an excessively porous medium which will be closer to natural, coarse sand. Water will leach most nutrients from such a porous medium, making nutrients unavailable to plants. Where only a porous medium is available, slow release fertiliser could be used in conjunction with closely monitored water application.

Seedlings have to be able to develop a root system that will later sustain the plant throughout its entire lifespan.

The medium has to provide as little resistance as possible to the developing roots. However, the medium must be sufficiently firm to hold seedlings and cuttings in place.

The range of media used includes:

- Composted pine bark
- Sawdust
- Vermiculite
- Perlite
- Peat moss
- Coconut fibre

Besides the considerations mentioned earlier, the propagator must take the following into account:

- Does the medium require any additional sterilisation? Can it be sterilised? At what cost?
- Is the salinity of the medium acceptable?
- Is the medium free of contaminants such as weeds, nematodes, pathogens and pesticides?

Fine sawdust is not recommended in the South African context, because of its property to compact quickly and reduce pore-space.

3.3 Problems with Propagation Media

Poor irrigation scheduling can lead to the alteration of the physical properties of the medium. Media that have a high WHC are less stable, can block easily and form a crust which prevents water from penetrating and resulting in roots starving from the lack of water and nutrients.

Pine bark is particular susceptible to poor irrigation scheduling. If kept dry too long, compounds such as cellulose and tannins found in the medium, coat the bark particles and prevent it from retaining water.

The medium must be suitable to the environment where propagation is taking place. Cuttings require a medium that allows roots to penetrate easily. In some cases, roots fail to penetrate in the medium and lift the cutting from its initial position. Plants produced under such conditions require special attention when transplanted in the container in the following stage.

If cuttings are propagated under mist, they require a medium that has a higher air-filled porosity to prevent moisture saturation in the root-zone.

3.4 The Effectiveness of Different Processes

Different processes are utilised to obtain propagation media. Some processes use organic material and transform it into growing medium through composting, while others mix different available materials to fabricate a medium that suits the need.

In South Africa, the cost of raw materials required for mixes is high. Composting requires the knowledge of the process of decomposition of material used. The most important factor for composting is the final ratio of carbon to nitrogen to avoid nitrogen immobilisation, leading to nutritional deficits. A ratio of 20:1 is preferred.

If the process is done correctly, composting provides the most economical option. Bark is available at a reasonable price and the supplier attempts to improve the product constantly.

3.5 Successful versus Non-Successful Propagation Media and Environments

The medium used for propagation, being clean and free from contaminants, is considered successful if the medium remains as such to the end of the process, when the crop is established in the field.

Successful propagation with regards to medium also implies the production of a strong and healthy plant with healthy root-system coverage in the medium.

Unsuccessful propagation relates to the plant not developing to its potential due to contaminants or pathogens preventing the roots from developing. A contaminated medium will lead to infection of the plant's root-system by weaken it with the result that the final product will be of an inferior quality.

ACTIVITY

Please complete Activity **9.**
Investigate and report

Investigate the propagation media used for the crop that is propagated at your place of employment.

Report on the following aspects:

1. The role of the propagation media that are used at your place of work
2. The potential problems that may be experienced due to the incorrect use of propagation media. Illustrate on past experience where possible.

How am I doing?

Concept (SO 3)	I understand this concept	Questions that I still would like to ask
The role of artificial propagation media in different propagation systems is described.		
Possible methods of solving propagation problems with reference to propagation media and environments are applied and described.		
The effectiveness of different processes with the propagation of material is compared and contrasted.		
Successful versus non-successful propagation media and environments are evaluated.		

My Notes ...

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Session 4 Process for the post-propagation activities

After completing this session, you should be able to:
SO 4: Establish a process for the post-propagation activities

In this session we explore the following concepts:

- Readiness for Transfer to Next Phase
- Pests and diseases

4.1 Introduction

Propagating plants requires the understanding of different physiological stages that the plant faces before it goes into production. The propagator must be able to match the growth stage to the appropriate environment of propagation to achieve the best results.

4.2 Readiness for Transfer to Next Phase

There are different stages at which propagated plants can be transferred or transplanted as seedlings. The population density, per surface area, decreases from the seed germination stage to polyethylene bags in shade-houses, including the seedling tray stage.

Transplant readiness in woody perennial plants is determined by the seedling development phase, seedling age, seedling size and climatic conditions. Transplant readiness differs between crops and between propagation methods. In citrus production, for example, propagators will transplant only when the weather is favourable i.e. warmer season after winter. In citrus production, the first transplant is done only according to the development stage while climatic conditions are overlooked as the first transplants are kept in a greenhouse.

Transplants from the greenhouse to the field takes place at stages as determined by the requirements of the specific crop. Transplants into the field are crop specific and have to be made to crop specific procedures. In addition, each type of propagation product is treated differently and these should also be done by following specific procedures.

4.3 Pests and diseases

Pest- and disease control follows the same procedures as for mature crops. Although some major pest and diseases are mentioned below, specific pest and disease management practices are implemented for specific crops and production areas which should be followed.

Foliar Damaging Pests

Foliage damaging pests, including those that cause encrustations on foliage and leaf eaters, are our major pest problems. A reduction in the leaf effective area will reduce the potential of the transplants for development.

Some important crop pests include:

- Red scale
- Mealy bug
- Aphids
- Citrus psylla
- Mites
- Thrips
- Loopers
- Slugs
- Red scale

  Red scale discolours the leaf and can turn it yellow, thus reducing the vitality of the plant. The surface area for photosynthesis is affected as little chlorophyll is synthesised. Severe infestations leads to leaf drop and twig die-back.

- Mealy bug

  Mealy bug is an oval, pale yellow insect covered in a powdery white wax. Adults are slow moving and secrete honeydew and black sooty mould. Heavy infestations cause leaf drop and reduced the photosynthesis rate.

- Aphids

  Aphids are either winged\wingless black and brown insects that secrete honeydew. Infected leaves are covered with sooty mould which in turn reduces the transpiration and photosynthesis rate. Leaf malformation is also been associated with aphid damage. In most cases the damage associated with aphids is not the direct damage but that associated with the viruses carried and transmitted by the aphids.

- Mites

  Red mites are oval-shaped. They feed on leaves and green bark of citrus plants. They prefer the upper surface of leaves which end up grey, silver or yellow. This affects photosynthesis and transpiration rates. Silver mites also have an oval-shape but are flat, straw coloured and translucent. They damage the leaves which become crinkled and may produce corky brown patches on the under-surface.

- Thrips

  Thrips are translucent orange-yellow in colour and wingless at immature stages, with adults having two pairs of narrow wings. The damage caused to citrus trees is found on young tender shoots and leaves that are malformed and result into stunted growth. Thrips extract chlorophyll from the infested plant parts, which then become pale.

- Loopers

  Loopers feed on leaves, starting at the margins of leaves. Both young and mature leaves are consumed by looper worms. Immature larvae have a different feeding pattern in that they first feed on the upper and lower epidermis and only then eat holes in the leaves.

- Slugs

  Slugs mainly eat holes in the crop's leaves.

Wood Damaging Pests

Rodents feed on the bark of young trees and shrubs in the nursery. Severe infestations may lead to the trees drying down. When feeding on smaller seedlings, rodents can cut off the stem.

Root Damaging Pests and Diseases

Nematodes feed on roots which then appear darker in colour. Rootlets become stunted, swollen and irregular in shape and appearance. Infested trees cannot tolerate stress or drought conditions.

Common root diseases of concern include root and stem rot caused by Phytophtora and dumping off caused by fungi including Rhizoctonia.

Root and stem rot, as well as dumping off start in the nursery and are generally expressed in the nursery before trees are planted in the fields. If the plant is infected at the end of the nursery cycle, the disease might not be detected in the nursery and only be expressed in the field.

Dumping off is a seedling disease. It only occurs in the seedling stage of propagation; from the germination until after the first transplanting.

4.4 Phases of Propagation

In most cases propagation occurs under controlled environments. At a pre-determined development stage, the plants is transplanted either to containers or planted in the field.

Each development phase requires specific environmental conditions for optimal growth. During the germination phase, light intensity, light quality, moisture, aeration, temperature and humidity are the most crucial factors. Once the seed has germinated, the physiological needs of the seedling require enough humidity to perform optimum transpiration.

Respiration and transpiration rates of the seedling determine the level of carbohydrates in the plant that can be used for growth. The more carbohydrates are used in the transpiration process, the less there is available to the plant for growth. Roots develop to ensure that the plant can sustain itself, absorb water and nutrients as well as anchoring the seedling in the medium. During the initial growing phase, humidity and temperature is controlled and humidity kept high. Should the plant then be transferred to a shade house, both humidity and temperature is reduced. The plant is thus subjected to lower humidity and light intensity. The thermal sheets or shade-cloth protect the plant from harsher environmental conditions of the immediate outdoor.

From one phase to the next the propagator must ensure that the transfer is done under optimum environmental conditions to avoid transfer shock.

4.5 Hardening-Off

Before the seedlings are transferred to shade-houses from greenhouses, seedlings are subjected to an acclimatisation process to minimise the transplant shock impact.

The seedlings are kept in a facility, for a minimum of a week, where the humidity is lower than in the greenhouse and light intensity is adjusted to resemble those of the ambient surroundings more closely. This leads to an accumulation of carbohydrates, increasing the ability of the plant to withstand its new environment and prevailing conditions.

Where cuttings are used, hardening off begins in the propagation area. The humidity is gradually reduced and the rooted cuttings become more hardened to function in physiological activities such as water and nutrient absorption, photosynthesis and leaf development.

4.6 Possible problems with Hardening-Off

Disease infested plants will not survive the hardening off period because of their reduced ability to survive.

Plants with poorly developed root systems will display an inability to survive under harsher conditions during the hardening off process.

Reducing light intensity may lead to the development of spindly and elongated plants. In some cases hardening off is done in structures covered in specialised netting such as aluminium coated netting, which diffuses light evenly in the structure. This aids in preventing the development of spindly plants.

Reduced humidity may lead to excessive water loss by the plant. If this problem is not corrected, plants will starve a pant (breathe with difficulty) death. It is thus crucial that irrigation programmes are adapted to suit the environment under which the plants are grown. In most cases a plant will require a 14 day period to adapt to an altered environment. This should be kept in mind when moving a plant from one environment to the next.

ACTIVITY

Please complete Activity **10.**
Investigate and report

For the propagation system used at your place of work, develop and implement a post propagation procedure highlighting the activities required for post propagation.

1. Determine and record the stepwise transplant requirements for the crop you work with.
2. Develop procedures that accurately describe this process
3. Determine and record the identification of the major pest and diseases for the crop you work with
4. Make use of crop pest and disease identification guides that will be provided to you.
5. How are these pests and diseases identified and managed at your place of work?
6. Discuss the monitoring programme followed
7. If a monitoring programme is not followed on the farm, develop such a monitoring programme. Identify the activities, the personnel responsible and he timing required.

ACTIVITY

Please complete Activity **10. (Continued)**
Investigate and report

For the propagation system used at your place of work, develop and implement a post propagation procedure highlighting the activities required for post propagation.

8. Discuss the various phases of propagation that are used for the propagation of the crop produced at your place of work

9. Discuss the hardening off process followed for the crop produced at your place of work.

10. Develop a transplant shock prevention programme for this crop.

How am I doing?

Concept (SO 4)	I understand this concept	Questions that I still would like to ask
Readiness of the propagated material to be transferred to the next phase is described and identified.		
The basic symptoms of pest or disease problems encountered in the propagation process are described.		
The different phases the propagated material passes through from the controlled environment to the field are explained.		
The possible problems that can be encountered with the hardening off process of the propagated material are solved and prevented.		
A hardening off process is established.		

My Notes ...

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Glossary

Term	Description
Apical dominance	Apical dominance refers to powerful tip growth that suppresses translocation of nutrients to other plant parts.
Diffusion	Diffusion is the spontaneous spreading of something such as particles, heat, or momentum. The phenomenon is readily observed when a drop of coloured water is added to clear water, or when smoke from a chimney dissipates into the air. In these cases, diffusion is the result of turbulent fluid motion rather than chemical reactions or the application of external force. In cell biology, diffusion is described as a form of "passive transport" by which substances cross membranes.
Dormancy	Dormancy refers to the ability of certain plant-parts, such as seeds, to suspend metabolic processes until ideal environmental conditions occur.
Embryo	The embryo is an animal or a plant in its earliest stage of development before an organism becomes self-supporting. Once the embryo begins to grow out from the seed, or germinate, it is called a seedling.
Grafting	Grafting refers to any process of inserting a part of one plant into or onto another plant in such a way that they will unite and grow as a single unit.
Humidity	Humidity, also referred to as *relative humidity*, is the amount of water vapour in the air at a given temperature and is expressed as a percentage. This means that at 20% relative humidity, 20% of any given volume of air will consist of suspended water molecules.
Meiosis	Meiosis is a process in organisms that reproduce sexually during which the nucleus divides into four nuclei, each of which contains half the usual number of chromosomes.
Metabolic processes	Metabolic processes refer to organic chemical processes inside a cell that enable life.
Osmosis	Osmosis is the flow of water (and other liquids) through a semi-permeable membrane, such as the thin membrane underneath the shell of an egg, from an area with a low concentration of dissolved matter, such as salts, to an area with a high concentration of dissolved matter, so that the concentration imbalance is gradually evened out.
Ovule	The ovule is a small structure inside the ovary of a seed plant that contains the female reproductive cells, the embryo sac and which develops into a seed after fertilisation.

Photosynthesis	Photosynthesis refers to the chemical reaction that takes place when the plant takes up CO_2, which combines with water molecules in the plant to produce carbohydrates, which is food for the plant. O^2 is released during this process.
Propagation	Propagation in citrus production refers to the multiplication of plant material that is of a specific cultivar and variety and which possesses more desirable characteristics, such as yield, fruit size, shape and internal quality.
Propagules	Propagules are the shoots, seeds, or other parts that plants use to spread or propagate, either sexually or vegetative.
Respiration	Respiration refers to the process during which the plant takes up oxygen (O_2) and releases carbon dioxide (CO^2).
Rhizospheres	The rhizospheres, also referred to as the root-zone, are the soil zone that surrounds the roots of the plant. This zone influences the roots and is in turn influenced by the roots.
Rootstock	Rootstock means the root or part of a root used for plant propagation. In reference to the process of grafting, the rootstock is that part of a grafted plant that supplies the roots.

My Notes ...

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Am I ready for my test?

- Check your plan carefully to make sure that you **prepare in good time**.
- You have to be found **competent** by a qualified **assessor** to be declared competent.
- Inform the assessor if you have any **special needs** or requirements **before** the agreed date for the test to be completed. You might, for example, require an interpreter to translate the questions to your mother tongue, or you might need to take this test orally.
- Use this worksheet to help you prepare for the test. These are **examples** of **possible questions** that might appear in the test. All the information you need was taught in the classroom and can be found in the learner guide that you received.

1. ***I am sure** of this and understand it well*
2. ***I am unsure** of this and need to ask the Facilitator or Assessor to explain what it means*

Questions	1. I am sure	2. I am unsure
1. Explain the Environmental Requirements for successful plant propagation.		
2. What is photosynthesis?		
3. What are the requirements for successful plant propagation?		
4. Why are environmental conditions monitored during propagation?		
5. Why is record keeping important?		
6. Why is it important to know and understand the propagation techniques used for the crops you grow?		
7. What is meant by sanitation during propagation?		

Checklist for practical assessment …

Use the **checklist** below to help you prepare for the part of the practical assessment when you are observed on the **attitudes** and **attributes** that you need to have to be found competent for this learning module.

Observations	Answer Yes or No	Motivate your Answer (Give examples, reasons, etc.)
Can you identify problems and deficiencies correctly?		
Are you able to work well in a team?		
Do you work in an organised and systematic way while performing all tasks and tests?		
Are you able to collect the correct and appropriate information and / or samples as per the instructions and procedures that you were taught?		
Are you able to communicate your knowledge orally and in writing, in such a way that you show what knowledge you have gained?		
Can you base your tasks and answers on scientific knowledge that you have learnt?		
Are you able to show and perform the tasks required correctly?		
Are you able to link the knowledge, skills and attitudes that you have learnt in this module of learning to specific duties in your job or in the community where you live?		

- ♦ The assessor will complete a checklist that gives details of the points that are checked and assessed by the assessor.
- ♦ The assessor will write commentary and feedback on that checklist. They will discuss all commentary and feedback with you.
- ♦ You will be asked to give your own feedback and to sign this document.
- ♦ **It will be placed together with this completed guide in a file as part of you portfolio of evidence.**
- ♦ The assessor will give you feedback on the test and guide you if there are areas in which you still need further development.

Paperwork to be done …

Please assist the assessor by filling in this form and then sign as instructed.

Learner Information Form				
Unit Standard	**116316**			
Program Date(s)				
Assessment Date(s)				
Surname				
First Name				
Learner ID / SETA Registration Number				
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			Signature:	

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Terms & Conditions

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- **Layout:**

  Ms N Matloa

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

REGISTERED UNIT STANDARD:

Propagate plants in a variety of situations

SAQA US ID	**UNIT STANDARD TITLE**		
116316	Propagate plants in a variety of situations		
SGB NAME		**REGISTERING PROVIDER**	
SGB Primary Agriculture			
FIELD		**SUBFIELD**	
Field 01 - Agriculture and Nature Conservation		Primary Agriculture	
ABET BAND	**UNIT STANDARD TYPE**	**NQF LEVEL**	**CREDITS**
Undefined	Regular	Level 4	3
REGISTRATION STATUS	**REGISTRATION START DATE**	**REGISTRATION END DATE**	**SAQA DECISION NUMBER**
Registered	2004-10-13	2007-10-13	SAQA 0156/04

PURPOSE OF THE UNIT STANDARD

A learner achieving this standard will be able to propagate plants.

Learners will gain specific knowledge and skills in plant propagation and will be able to operate in a plant production environment implementing sustainable and economically viable production principles.

They will be capacitated to gain access to the mainstream agricultural sector, in plant production, impacting directly on the sustainability of the sub-sector. The improvement in production technology will also have a direct impact on the improvement of agricultural productivity of the sector.

LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING

It is assumed that a learner attempting this unit standard will show competence against the following unit standards or equivalent:

- NQF 3: Explain the propagation of plants.
- NQF 4: Demonstrate a basic understanding of the physiological processes in plant growth and development.
- NQF 3: Explain the planning and scheduling of tasks in a production environment.
- NQF 3: Interpret and maintain factors influencing agricultural enterprises and plan accordingly.

UNIT STANDARD RANGE

Whilst range statements have been defined generically to include as wide a set of alternatives as possible, all range statements should be interpreted within the specific context of application.

Range statements are neither comprehensive nor necessarily appropriate to all contexts. Alternatives must however be comparable in scope and complexity. These are only as a general guide to scope and complexity of what is required.

UNIT STANDARD OUTCOME HEADER

N/A

Specific Outcomes and Assessment Criteria:

SPECIFIC OUTCOME 1

Recognise and use propagation structures, facilities and materials under supervision and do problem solving in relation to processes and maintenance.

OUTCOME RANGE

The propagation structures include but are not limited to sexual and asexual parts of the plant. Facilities include but are not limited to controlled, protected or open field environments.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The propagation structures available for the propagation of plant material for different production systems are identified and evaluated.

ASSESSMENT CRITERION 2

Potential faults of the structures and describe the effect on the success or failure of propagation material are identified.

ASSESSMENT CRITERION 3

The effect of different propagation media on the success or failure of propagation material is described.

ASSESSMENT CRITERION 4

Growing media components are properly measured mixed in form of composition and sterilised.

SPECIFIC OUTCOME 2

Propagate a variety of plant types using different asexual methods.

OUTCOME RANGE

Asexual propagation methods include but are not limited to plant cuttings, budding and grafting (basic).

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The different methods of asexual propagation are identified and applied and best practice is selected.

ASSESSMENT CRITERION 2

The different methods of asexual propagation in relation to the types of plants are explained.

ASSESSMENT CRITERION 3

The different types of budding and grafting methods are applied and explained.

ASSESSMENT CRITERION 4

The use of hormones for asexual propagation is described.

ASSESSMENT CRITERION 5

Methods to guide a team to use the correct sanitary measurements in propagation procedures are applied.

SPECIFIC OUTCOME 3

Experiment with different types of propagation media and environment.

OUTCOME RANGE

Propagation media includes but is not limited to artificial media, soil, peat moss, heated and humidified seed boxes etc. Environment includes but is not limited to controlled atmosphere, open fields etc.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The role of artificial propagation media in different propagation systems is described.

ASSESSMENT CRITERION 2

Possible methods of solving propagation problems with reference to propagation media and environments are applied and described.

ASSESSMENT CRITERION 3

The effectiveness of different processes with the propagation of material is compared and contrasted.

ASSESSMENT CRITERION 4

Successful versus non-successful propagation media and environments are evaluated.

SPECIFIC OUTCOME 4

Establish a process for the post propagation activities.

OUTCOME RANGE

Post propagation activities include but are not limited to the pest and disease control of, fertilising and irrigation of, hardening off of, and transferring of propagated material to different environments.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

Readiness of the propagated material to be transferred to the next phase is described and identified.

ASSESSMENT CRITERION 2

The basic symptoms of pest or disease problems encountered in the propagation process are described.

ASSESSMENT CRITERION 3

The different phases the propagated material passes through from the controlled environment to the field are explained.

ASSESSMENT CRITERION 4

The possible problems that can be encountered with the hardening off process of the propagated material are solved and prevented.

ASSESSMENT CRITERION 5

A hardening off process is established.

UNIT STANDARD ACCREDITATION AND MODERATION OPTIONS

The assessment of qualifying learners against this standard should meet the requirements of established assessment principles.

It will be necessary to develop assessment activities and tools, which are appropriate to the contexts in which the qualifying learners are working. These activities and tools may include an appropriate combination of self-assessment and peer assessment, formative and summative assessment, portfolios and observations etc.

The assessment should ensure that all the specific outcomes; critical cross-field outcomes and essential embedded knowledge are assessed.

The specific outcomes must be assessed through observation of performance. Supporting evidence should be used to prove competence of specific outcomes only when they are not clearly seen in the actual performance.

Essential embedded knowledge must be assessed in its own right, through oral or written evidence and cannot be assessed only by being observed.

The specific outcomes and essential embedded knowledge must be assessed in relation to each other. If a qualifying learner is able to explain the essential embedded knowledge but is unable to perform the specific outcomes, they should not be assessed as competent. Similarly, if a qualifying learner is able to perform the specific outcomes but is unable to explain or justify their performance in terms of the essential embedded knowledge, then they should not be assessed as competent.

Evidence of the specified critical cross-field outcomes should be found both in performance and in the essential embedded knowledge.

Performance of specific outcomes must actively affirm target groups of qualifying learners, not unfairly discriminate against them. Qualifying learners should be able to justify their performance in terms of these values.

- Anyone assessing a learner against this unit standard must be registered as an assessor with the relevant ETQA.

- Any institution offering learning that will enable achievement of this unit standard or assessing this unit standard must be accredited as a provider with the relevant ETQA.

- Moderation of assessment will be overseen by the relevant ETQA according to the moderation guidelines in the relevant qualification and the agreed ETQA procedures.

UNIT STANDARD ESSENTIAL EMBEDDED KNOWLEDGE

The person is able to demonstrate a basic knowledge of:

- Basic safety requirements related to the propagation environment, tools and procedures.
- Basic hygiene requirements for the propagation environments.
- Growing media - wet and dry.
- Weeds, pest and diseases.
- The safe use and handling of a variety of Chemicals and hormonal and other organic preparations.

UNIT STANDARD DEVELOPMENTAL OUTCOME

N/A

UNIT STANDARD LINKAGES

N/A

Critical Cross-field Outcomes (CCFO):

UNIT STANDARD CCFO IDENTIFYING

Problem Solving: In relation of all processes of plant propagation.

UNIT STANDARD CCFO WORKING

Teamwork: Especially in relation of his role as leader of a team.

UNIT STANDARD CCFO ORGANIZING

Self-Management: Good organisational skills are critical.

UNIT STANDARD CCFO COLLECTING

Interpreting Information: Especially interpreting environmental interaction.

UNIT STANDARD CCFO COMMUNICATING

Communication: As leader of a team essential.

UNIT STANDARD CCFO SCIENCE

Use Science and Technology: Basic knowledge in relation of all processes.

UNIT STANDARD CCFO DEMONSTRATING

The world as a set of related systems.

UNIT STANDARD CCFO CONTRIBUTING

Self-development: Especially management, organisation and communication critical.

UNIT STANDARD ASSESSOR CRITERIA

N/A

UNIT STANDARD NOTES

N/A

QUALIFICATIONS UTILISING THIS UNIT STANDARD:

	ID	QUALIFICATION TITLE	LEVEL	STATUS	END DATE
Core	49009	National Certificate: Plant Production	Level 4	Registered	2007-10-13