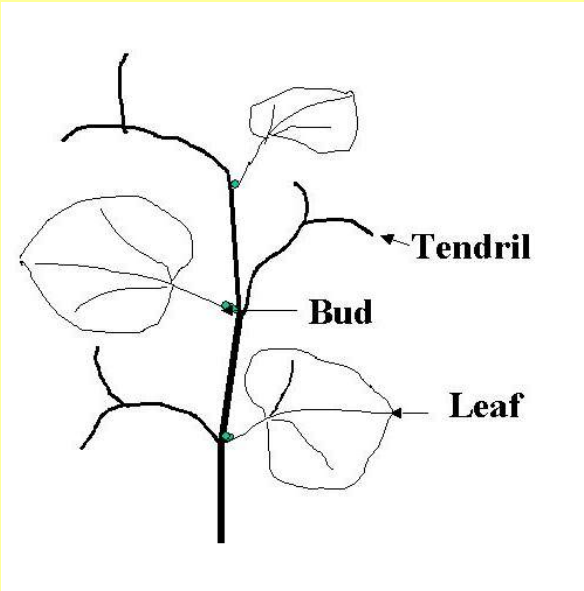


NQF Level: 4 US No: 116305

# Learner Guide

## Primary Agriculture

### Plant manipulation methods



My name: .....

Company: .....

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

## Before we start...

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

<b>Title:</b>	Manage plant manipulation methods of an agricultural crop		
<b>US No:</b>	116305	<b>NQF Level:</b>	4
		<b>Credits:</b>	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	<input type="checkbox"/>
National Certificate in Plant Production	49009	4	120	<input type="checkbox"/>

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?	<input type="checkbox"/>	<input type="checkbox"/>
Skills Program?	<input type="checkbox"/>	<input type="checkbox"/>
Short Course?	<input type="checkbox"/>	<input type="checkbox"/>

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?

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# What will I be able to do?

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

- ◆ A learner achieving this unit standard will be able to implement a plant manipulation management plan using a broad range of techniques. Learners achieving this unit standard will be able to apply their skills and capacity in a variety of production environments and be able to contribute towards to overall productivity of a production enterprise by maximizing growth and yield and maintaining high standards of practice.
- ◆ Learners will gain specific knowledge and skills in plant manipulation processes 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.
- ◆ Determine the correct growth stage for manipulating a specific crop.
- ◆ Caring and maintaining of equipment
- ◆ Create and implement a manipulation schedule.
- ◆ Erect a trellising system for a specific crop.
- ◆ Manipulating buds (growing points).
- ◆ Shaping the plant.
- ◆ Manage flower and fruit manipulation.
- ◆ Establish a spraying program for chemical manipulation.
- ◆ Establish a program for physical manipulation.
- ◆ Maintain appropriate hygiene and health standards.

## Learning Outcomes

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

- ◆ Tools for manipulation of plants.
- ◆ Trellising methods.
- ◆ Flower manipulation and fruit manipulation methods.
- ◆ Pruning methods.
- ◆ The principles of manipulation of a plant.
- ◆ Names and functions of tools and materials.
- ◆ Safe handling procedures of tools and material.
- ◆ Maintaining hygienic procedures of tools and material as to prevent spreading of diseases.
- ◆ Plant physiology and anatomy.
- ◆ Interpret a plant manipulation management plan.
- ◆ Create and implement a plant manipulation schedule.
- ◆ Supervise the implementation of a plant manipulation schedule.
- ◆ Maintaining appropriate hygiene and health standards.



## Session

# 1 Plant manipulation management

*After completing this session, you should be able to:*

**SO 1: Interpret a plant manipulation management plan.**

**In this session we explore the following concepts:**

- ◆ In this module the learner is going to learn how to interpret and implement a plant manipulation plan.
- ◆ Manage the caring and maintenance of tools and equipment
- ◆ Manage and solve problems in the use of tools and materials
- ◆ Correct plant growth stage for pre-determined manipulation method

## 1.1 Manage the caring and maintenance of tools and equipment

The schedule described below could be applied to different crops like citrus, mangoes, avocados, apples, peaches and vineyards. Basically the same equipment and implements will be needed to fulfill the tasks.

Tools and equipment are stored safely in stores and the storekeeper should be notified timely about the kind of equipment required and the quantity of each. Each worker must be fully trained and equipped with the necessary safety clothes, hats gloves and shoes suitable for the kind of manipulation operation. First aid kits need to be checked and stocked.

Tools like pruning shears need to be sharpened and lubricated, cleaned and sterilised before use. Larger machines like hedge pruners, spray carts and tractors need to be serviced (See US No. 116290).

Quantities and expiring dates of chemicals for flower and fruit manipulation must be checked and new batches ordered if required. Make sure that the chemicals are indeed registered for the specific crop.

Checking the spray cart involves the following: (Taken from Module No 116290)

- Check that universals on the PTO shaft are greased.
- Grease all the nipples.
- The boom-hoses are intact.
- The nozzles are not blocked or leaking.



- The pump readings compare with handbook/manual as prescribed.
- The calibration is correct.
- The filters are clean or replaced.
- The tyre pressure is correct.
- The hydraulic hoses are intact.
- The agitation system is correct.
- The boom height is set correctly.
- The anti drip device is in order.
- Check the accuracy of flow sensor, single nozzle flow rate and rate control system.
- Check the consistency of dose rate.
- Check the uniformity of transverse liquid spray distribution (Calibration).

## 1.2 Manage and solve problems in the use of tools and materials

Examples of problems related to manipulation that can be confronted with and possible reasons are dealt with in the following table:

Problem	Possible reason
<b>Pruning</b>	
Pruning shear tear shoots instead of cutting	Adjust blades with adjusting nut and/or sharpen blade
Thick branches tear bark when cut	Incorrect method of cutting – check correct technique
Too vigorous vegetative growth after hedge- pruning	Spray growth retardant like ‘Pacrobtrazol*’ after pruning
Young trees top over	Trees not properly staked or trained
Too many fruits per tree	Bearing units not properly thinned out or pruned back or flowers/fruit not properly thinned out
Too low crop yield	Too many bearing units removed; too heavy crop during preceding season:
Poor fruit colour	Canopy too dense – too little light penetration; no summer pruning was done: wrong trellising system
<b>Chemical manipulation</b>	
Buds do not sprout in spring	Too low number of cold units during winter; trees not sprayed with ‘Dormex’ or similar chemical to break dormancy*
Too many flowers per bearing unit	Spray flower thinner*
Too high fruit set	Spray fruit thinner* or thin manually
Fruit too mall	Insufficient flower or fruit thinning
Poor fruit size	Spray chemical* to improve fruit size
Poor fruit colour	Spray chemical* to improve fruit colour
Too early flowering	Spray chemical* to delay flowering

Phytotoxic symptoms after spraying

Check prescribed concentration (label on container) and calibration of sprayer; check pH and water quality, was the sprayer properly cleaned to remove residues of previous chemicals?

Poor spray cover

Check nozzles or other blockages in sprayer

## 1.3 Correct plant growth stage for pre-determined manipulation method

### ■ Planting material

One of the first steps in orchard tree manipulation is the selection of planting material that is grafted on specific rootstocks. Rootstocks are selected for disease tolerance, tolerance for salinity, production capacity, cold tolerance and tree size. Choosing planting material that was grafted on a 'wrong' rootstock can have serious consequences on the eventual production of the orchard.

In crops like apples and almonds, pollen incompatibility is a very important aspect. Pollen providing trees (pollinisers) of a specific cultivar is inter-planted at a specific ratio to make sure that effective pollination will take place. Planting material, therefore, have to be ordered well in advance to make sure that the correct numbers of pollinisers and production trees are ready on the day planting commences.

### ■ Pre-planting and planting

It is a given fact that no manipulation method can be applied in any growth stage of the specific plant or time of the year. For crops that need to be trellised, like tomatoes in tunnels and some orchard trees and vines, the systems are usually erected after soil preparation and installation of the irrigation system, but before the plants are planted.

Part of the crop management plan is to make sure that all materials needed for erecting the training or trellising systems are ordered and delivered on the site before the planting season starts (Usually August/September). Training of young trees starts during planting by staking the young trees to support the tender stems. The lower part of the stem is also covered with thick plastic or other material to shield the stem against contact with herbicides and sunburn.

### ■ Pruning

In deciduous tree crops, winter pruning is done in mid-winter to early spring when trees are in a dormant state. Framework branches and bearing units are then clearly visible that makes it easy for further framework development, re-shaping, pruning back and thinning out. Evergreen fruit trees like avocados, mangoes and litchis are pruned after harvesting to allow sufficient time for new growth to harden off and

terminal buds to 'mature' before winter. (Rested terminal buds will produce new flowers in spring).

### ■ Chemical manipulation

Flowering in young mango trees can be **inhibited** by spraying trees with gibberellins. Preventing the young trees to flower will allow more vegetative growth after planting instead of reproductive growth. Trees must be sprayed during late July to early August.

After a mild winter, **delayed foliation** can be alleviated in apples and other deciduous fruit types by spraying DORMEX (cyanamide) 4-5 weeks before bud-burst or 5-6 weeks before expected full bloom.

DORMEX and fertilisers like ammonium- thiosulfate (ATS) and the growth retardant paclobutrazol can also be used for **flower thinning** in apples.

Chemical **fruit thinning** in grapes can be achieved by spraying gibberellins at 2.5g/l (water soluble granules) at the stage of 50 % calyx drop (cap fall) or 50% bloom'. A second application should be made at 80% bloom. In peaches (cultivar Neetling), gibberellins at 200ml/100l water (soluble concentrate) can be applied 4 weeks before harvest to thin out fruit.

In Forelle Pears, **fruit set** can be improved by spraying gibberellins (soluble concentrate) at 32ml/100liter water at 30-40% flowering.

**Colour development** in apple and pineapple fruit can be improved by spraying ethephon. For apples, spray 75-85 ml/100liter water, 2-3 weeks before expected harvesting. Lower concentrations should be applied when temperatures are high. Ethephon will also enhance ripening of the fruit. For pineapples, spray 2-4 liter / hectare at the stage when natural colour change starts.

From the above it is clear that gibberellins can be applied for different reactions provided that prescriptions regarding cultivar, formulation stage of plant growth and concentrations are meticulously followed. More details are available in Department of Agriculture, 2007.



Please complete Activity 1:

Select a crop in your area, find a manipulation plan for the crop, interpret the plan and write notes on the following:

1. How you will manage the use of appropriate tools and equipment and how related problems will be solved and how you would manage the caring for the equipment?
2. The correct stages when different manipulation methods should be applied



# Session 2 A plant manipulation schedule

*After completing this session, you should be able to:*

**SO 2: Create and implement a plant manipulation schedule**

**In this session we explore the following concepts:**

- ◆ Erecting the trellising system
- ◆ Manipulation of growing points (buds) and bearing units and shaping the plant
- ◆ Solving problems related to manipulation and framework development

There are many ways to manipulate plants and many different schedules can be worked out. In this section, however, we are just going to look at a schedule for erecting a trellising system for table grapes. Except for the traditional growing areas in the Western Cape, table grapes are now also grown along the Gariep River (Orange River) near Upington in the Northern Cape, in the Northern Province near Rustenburg and Brits as well as in Mpumalanga near Marble Hall. To establish a vineyard is a huge investment and in areas where hail can be a problem, the grower/farmer has to make provision for hail netting that escalates the investment even more. There are a number of systems from which to make a choice, but in this section we are going to follow a schedule for erecting a factory cap trellis system fitted with hail netting suitable for the Mpumalanga area. The choice of the trellis type will also be affected by the choice of the cultivar(s).

The following points should have been considered before implementing the trellising system schedule:

1. Availability of financing
2. Soil quality, aspect and slope of intended vineyard
3. Cultivar choice (Consult expert)
4. Area to be planted
5. Water source and quality
6. Direction of prevailing winds
7. Intended irrigation system
8. Type of trellising system
9. Proper diagram or plan of the system (Consult trellising expert)
10. Soil preparation

## 2.1 Erecting the trellising system

1. Study the diagram/plan of the system (Figure 1)
2. Order all materials required for the erection of the trellis
3. Supervise the lay-out of the system, super imposed onto the irrigation system plan (Row orientation to be North/South if possible)
4. Measure and mark position of uprights (Plant rows to correspond with short uprights)
5. Dig holes (0.5 m deep) for the poles by using a mechanical auger
6. Dig trenches for irrigation system (Consult irrigation expert)

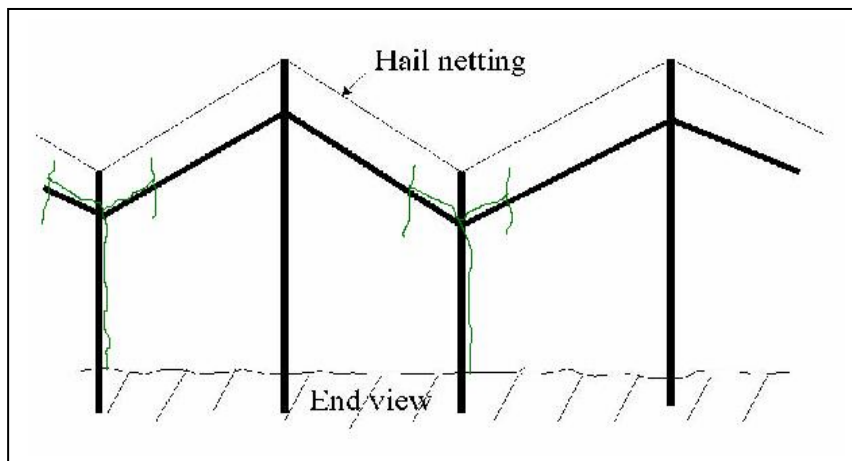


Figure 1: Double slanted cap or gable system suitable for double split cordon training system (indicated in green)

7. Long and short uprights to be of equal length
8. Drill holes in uprights and slanting gable poles for bolts
9. Insert and stabilise poles in holes as indicated in diagram (Figure 2). Make sure that uprights are in straight lines and perfectly vertical
10. Fit slanting gable poles, insert bolts and tighten nuts
11. Anchor all corner and end uprights securely
12. Fit wiring system – four wires per gable pole for double split cordon and wire system for carrying hail netting.
13. Fit white hail netting (Consult netting expert for details)
14. 14Install irrigation system
15. 15Dig holes for plants between short uprights
16. Plant during August/September

## 2.2 Manipulation of growing points (buds) and bearing units and shaping the plant

In the previous section we have concentrated on a trellising system for table grapes. In this section we will start off with the manipulation of table grape buds

before we start dealing with bud manipulation of other crop species.

Planting material for table grapes is made up of scions of the desired cultivar which is grafted onto suitable rooted cuttings that are supplied as one year old, bear rooted plants.

After planting, the scion is cut back to two buds. During the first season two or more shoots (canes) will develop. After the first winter the weaker shoots are removed and the strongest shoot is again cut back to two buds. Shoots developing from these buds are trained onto a line suspended from the cordon wires. During the season the weaker shoot is topped to stop further growth. The stronger shoot is allowed to grow up to the cordon wire where it is topped (Figure 2)

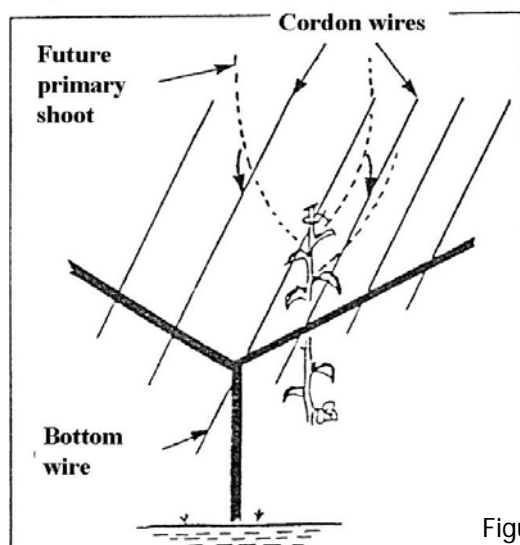


Figure 2: First topping of primary shoot (Future main stem)

Each of the two strongest shoots developing from the most terminal buds below the topped end are trained to grow in two opposite directions towards the two adjacent slanting gable poles carrying the cordon wires. After reaching a length of about 35 to 40 cm above the cordon, they are topped again. The plant will now have the shape of a 'Y' (Figure 3).

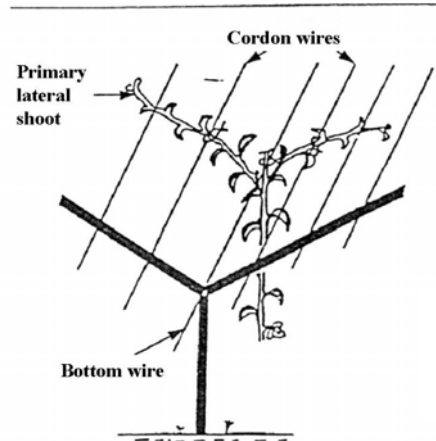


Figure 3: Topping of primary lateral shoots

Shoots developing from the ends of the Y arms are trained in opposite directions along the two opposite second cordon wires as soon as they have become woody enough not to snap when tied to the wires. (Figure 4)

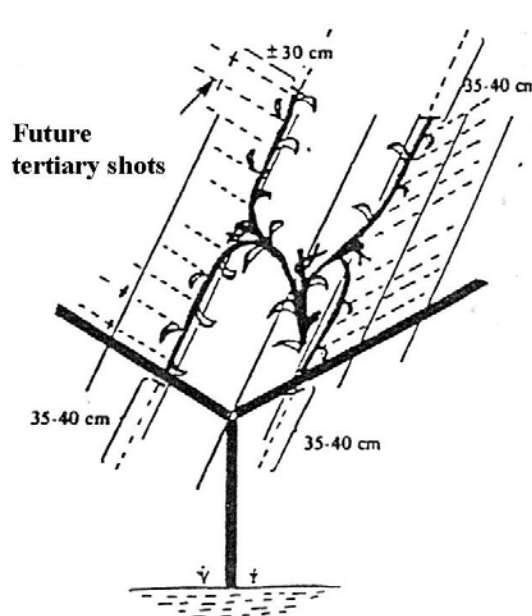


Figure 4: Topping of secondary shoots (Cordons) and tying them onto the cordon wires.

Topping the shoots (removal of the apical bud) also contradicts apical dominance of the terminal bud, resulting in the sprouting of the buds closest to the cut end. In this way the growth of the shoots can be easily manipulated to achieve the desired training structure. By topping the secondary lateral shoots (cordons), the buds in the axils of the remaining leaves will sprout to give rise to tertiary shoots. Towards



the end of the ensuing winter, the tertiary shoots are pruned back to one bud (Figure 6). After the winter this bud will sprout to produce a cane that will produce the next year's crop.

To understand manipulation in grapes, it is essential to also understand how grapes grow. As shown in Figure 5, the growth of grapes is sympodial or modular, which means that the terminal bud will produce one module consisting

of an internode and a node with a leaf and two buds in its axil before terminating in a tendril.

One of the axillary buds sprouts will give rise to another module and the whole process repeats itself as long as conditions are favorable and sufficient energy is available.

When the \*remaining bud in the leaf axil sprouts, the first two to three modules of the resulting cane do not terminate in tendrils as indicated in Figure 5, but do terminate in inflorescences (future grape bunches) instead, while the following modules on the cane terminate in tendrils again. It is for this reason that when pruning in winter, canes are pruned back to the two basils, reproductive buds as shown in Figure 6.

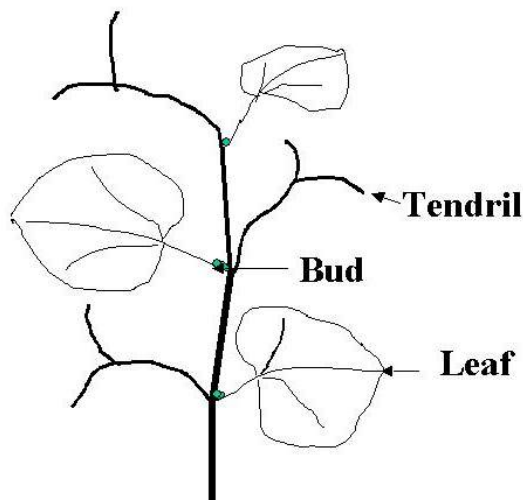


Figure 5 Diagram illustrating grape vine growth

The remaining buds in the leaf axils become dormant and need a minimum number of cold units before they will sprout during the following season. In some cultivars requiring more cold units, these buds need to be chemically manipulated to sprout.

Figure 6 shows the stump of the first tertiary cane that was pruned back to one bud during winter of season X1. This bud produced a cane that was pruned back to two basal reproductive buds during winter of season X2. The latter buds each produced a cane from which the basal modules produced grape bunches instead of tendrils while the buds in the basal leaf axils became reproductive. Figure 6 shows how these canes were pruned back to two buds again during the winter of season X3.

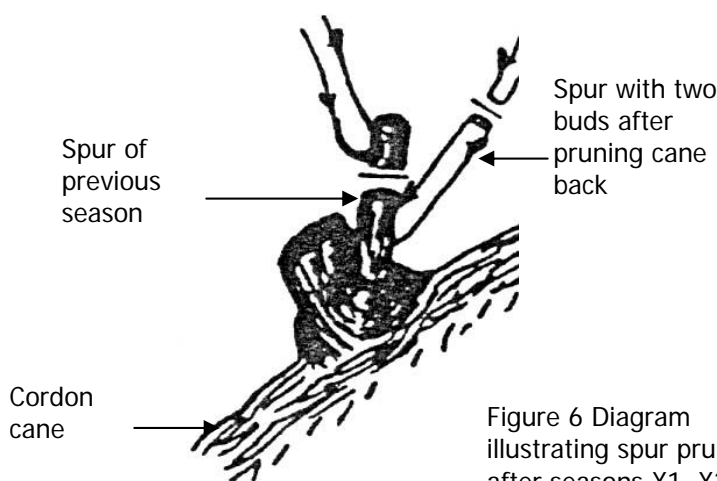


Figure 6 Diagram illustrating spur pruning after seasons X1, X2 and X3

Apart from the trellising system described above, there are many more systems to choose from like the slanted 'T'-cap system (Figure 7)

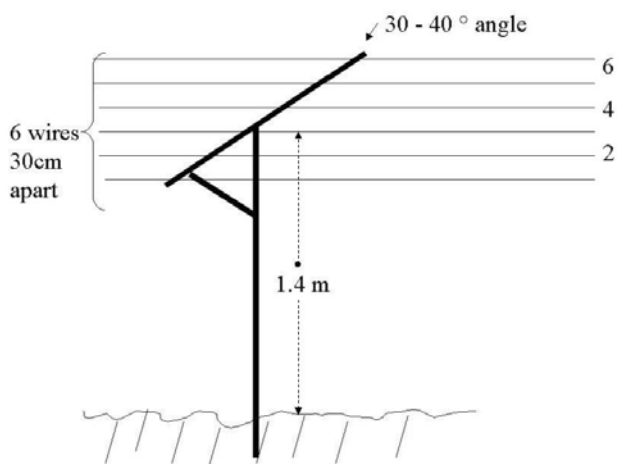


Figure 7: Slanted 'T'-cap system suited for a split cordon system Fig.8)

and also different systems of training like the single split cordon or the double split cordon (Figure 8)

In the case of a single split cordon, four wires are used and for a double split cordon, six wires are used. The cordon arms are tied to wires 2 and 4 and are called

'fruiting' wires, while wires 1, 3, 5 and 6 are used for foliage developing on the distal parts of canes.

The spacing of plants in the row, the open spaces between cordons on the wire and spacing of spurs on the cordons are important aspects to consider. Although figures are given in Figure 8, it is recommended that an expert should be consulted for information concerning specific cultivars before planting and manipulation.

Other manipulations that might be necessary on grapes are thinning out of berries on bunches and 'loosening' bunches.

Thinning can be done manually by using small pruning shears or scissors to cut out small, diseased and damaged berries or berries that are too closely spaced on the axes of the bunch.

A chemical like gibberellins can also be used for 'loosening' bunches due to its effect on cell elongation. The bunch's axes become longer if applied before bloom when trusses (clusters) are 60-80mm long.

Berry size of 'Thompson Seedless' grapes can be improved by applying *forchlorfenuron* (Cytotefx) when berries are 4-5 mm in diameter. Colour development of 'Barlinka' grapes can be improved by applying ethephon at the stage of 50 % colouring.

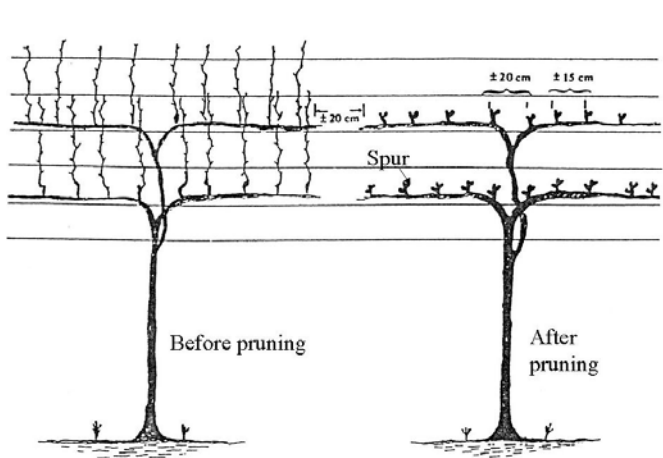


Figure 8: Double split cordon on a slanted 'T'-cap system before pruning (left) and after pruning (right)

**My Notes ...**

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## 2.3 Solving problems related to manipulation and framework development

Many problems can turn up during framework development and manipulating plants to react differently to 'normal' behaviour under a variety of conditions. A few of such problems and possible ways of solving them are listed in the following table:

### Solving problems related to manipulation and framework development

Problem statement	Possible solution and/or reason
1. Not sure about the kind of trellising to use	Consult an expert
2. Materials for trellising system not readily available	Start planning early to allow time for shopping around
3. Staff not trained to do the job	Get expert to guide them and to supply the necessary tools
4. Required plant material not available	Order one year before planting from reputable nursery
5. Farm located in windy area	Plant windbreaks before planting
6. Plants grow too slowly in spite of adequate water and fertilisers and pest and disease control	Apply growth stimulants like <i>auxins</i> and <i>cytokinins</i>
7. Internodes on future cordon arms are too long to fit in enough bearing shoots (Tertiary shoots)	Cut on fertiliser's nitrogen, cut shoots back and start over.
8. Delayed sprouting of buds.	Lack of sufficient cold units – spray with <i>Dormex</i> or similar chemical to break dormancy
9. Poor fruit set	Lack of pollinators or self-incompatibility. Introduce bee hives.
10. Berry shatter and straggly bunches of 'Waltham Cross'	Spray or dip bunches in <i>forchlorphenuron</i> when berries are 4-6mm in diameter
11. Berries too small	Spray <i>auxins</i> and <i>cytokinins</i> (see Dept. of Agric.2007)
12. Poor colour development on cultivar 'Barlinka'	Remove basal leaves around bunches or spray <i>ethephon</i> at stage of 50% colour development
13. Cultivar in old vineyard no longer in demand	Cut main stem about 0.5m above ground level and graft scions of new cultivar on stump (Bark grafting)



# Session 3 Supervision

After completing this session, you should be able to:

**SO 3: Supervise the implementation of a plant manipulation schedule.**

In this session we explore the following concepts:

- ◆ Manage flower and fruit manipulation
- ◆ Establish a spraying program for chemical flower/fruit manipulation.
- ◆ Establish a program for physical fruit and flower manipulation.

In this section we are going to learn about the implementation of a plant manipulation schedule, first for grapes to link up with the previous section and then expand the concepts to other crops as well.

## 3.1 Manage flower and fruit manipulation

Aspects of flower and fruit manipulation have already been touched on in the previous sections, but more information will be supplied in this section while concentrating on the managing aspects.

Treatments for flower and fruit problems are supplied in the table below:

Problem	Suggested treatment	Benefiting crops
Late foliation or Dormant buds.	Dormex® (cyanamide)	Apples, pears, peaches & grapes.
Flower induction	Ethephon	Pineapples
Improving fruit set	Supply bee hives Girdling	Most fruit types, Citrus, sunflower, grapes & avocados.
Flower thinning out.	Manual thinning out	Any crop that needs thinning out.
Fruit thinning out.	Dormex® (cyanamide)	Apples
	Carisil E®	Grapefruit
	Maxim®	Oranges, Clementines, Satsumas and Grapefruit
	ProGib® (gibberellins)	Apples, peaches
	Cultar® (paclobutrazol)	Plums
	Dormex® (cyanamide)	Plums
	Manual thinning out.	Any crop that needs thinning

Berry shatter	Sitofex®(forchlorfenuron)	Grapes
Improvement of fruit shape and size.	Sunny® (unconazole) Maxim® Girdling.	Apples, apricots, Citrus, avocados, Orange, Clementines, Satsumas and Grapefruit Avocados.
Fruit colour improvement	Ethephon	Apples, pineapples & citrus.
Fruit ripening	Ethephon	Most climacteric fruit like apples, bananas, avocados etc,
Creasing reduction	ProGib® (SL) or Falgro® Tablets (TB)	Citrus

Most chemicals mentioned in the above table are supplied in different formulations as indicated on the label, e.g. soluble concentrate (SL), emulsifiable concentrate (EC), wettable powder, water soluble powder (SP), water dispersible granule (WG) and tablets (TB). The manager must make sure to use the correct formulation at the prescribed concentration for the specific cultivar and at the right stage of flower and fruit development (See Department of Agriculture, 2007). It is also important to consider economic aspects since spray programs can be very costly.

## 3.2 Establish a spraying program for chemical flower/fruit manipulation

### ■ Pineapples

Of all the crops, pineapple production is the most dependent on chemical manipulation and therefore this program is designed for pineapple production where timing is the main managing tool.

#### ◆ Flower induction

Pineapples are grown from vegetative material obtained from the previous crop like slips (kind of cutting), crowns or suckers. Depending on the time of planting, the plants start normal flowering during winter. Flowering can also be very uneven, resulting in problems during harvesting. 'Flower forcing' or flower induction can be applied, which means that the crop can be sprayed with Ethephon (1liter + 80 kg urea spray) per hectare at the stage when normal flowering starts. This treatment will lead to uniform flowering of the whole crop. For Queen pineapples 125 ml Ethephon + 2.5 kg of spray urea per hectare can be applied to the crowns of individual plants.

#### ◆ Fruit mass increase and delay in maturity

If the fruits are still too small at the stage of 3 months before anticipated harvesting, they can still be treated with a full 'Swelpine' (cloprop) cover spray. This treatment will also delay the harvesting period.

◆ Colouring of fruit

Pineapple fruit normally reach the required sugar content while the colour of the fruit is still green. To improve the fruit colour and earlier marketing, the fruit can be sprayed with Ethephon again (concentration of 2 – 4 liters per hectare) at the stage when colouring is just starting.

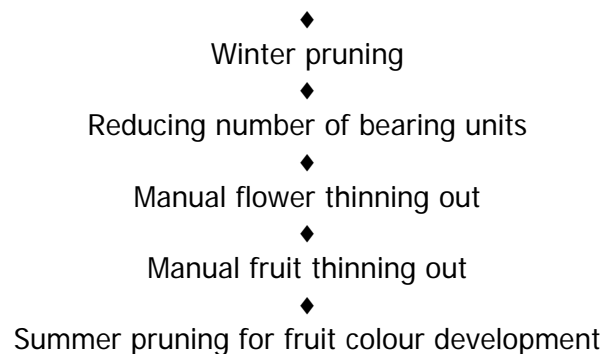
For other crops flower and fruit manipulation is not a standard procedure as in the case of pineapples but treatments are done as demanded by the specific crop when specific problems turn up.

Most chemicals are applied with sprays and for this reason managers must make sure the spraying equipment is available and in good working condition at the critical stages. Workers should be well trained, equipped with the necessary protective gear and well informed about the specific spray program.

### 3.3 Establish a program for physical fruit and flower manipulation

Most of the physical fruit and flower manipulation actions for different fruit types have already been mentioned in the table under section 3.1. In this section we are going to concentrate on more details for stone fruit (nectarines, peaches, plums & apricots.)

#### Summary of manipulation program



#### ■ Reducing number of bearing units

Stone fruit flowers are normally produced either on spurs (apricot) or on one year old shoots (peaches). During winter pruning, the canopy is opened for light penetration while long bearing shoots are thinned out or pruned back or the number and spacing of spurs are reduced if required. Spurs can produce flowers for more than a year while bearing shoots produce flowers for one season only. Sufficient vegetative buds should also be left for producing spur-bearing or flower bud-bearing shoots for the coming season.



## ■ Flower thinning

In spite of winter pruning, it can still happen that too many flowers are produced per branch. In this case too closely spaced flower buds or open flowers are removed, keeping in mind that not every flower will be pollinated to produce a fruit. More flowers than the final number of fruit per bearer should therefore be left. The best quality fruit are produced at the basal part of the tree and therefore more bearing units should be left around the base. Only well-trained staff should be allowed to perform this task. Using tweezers can help to prevent damaging closely spaced buds or flowers when extra flowers/buds are removed.

## ■ Manual fruit thinning

At the stage of fruit thinning out, tree has already produced mature leaves. Since leaves are the food manufacturing organs of the plant, the ratio of leaves to fruits is of utmost importance. The aim is to produce the maximum number of fair-sized fruit while saving enough energy reserves (produced by the leaves) in the tree for the next season's crop.

Fruit thinning out is the most important activity of the year program and is often neglected. The aims are:

- Bigger and better quality fruit.
- Reduction of production cost due to fewer, better fruit.
- Uniform size fruit for packing.
- Better prices for bigger fruit.

The thinning out of fruit can only be done during the early stages of fruit development..... before hardening of the stone, (about 40 days after pollination), thus, after the cell division period. Start with early cultivars first before moving to later cultivars. For peaches and plums, one fruit can be left for every 15 cm of the bearing shoot.



Please complete Activity 3:

Select a crop in your area that needs manipulation and write notes under the following headings on how you are going to supervise the implementation of a manipulation schedule:

1. Managing flower and fruit manipulation
2. Establishing a spraying program for chemical flower and fruit manipulation
3. Establishing a program for physical flower and fruit manipulation



## Session

# 4 Hygiene and health

*After completing this session, you should be able to:*  
**SO 4: Maintain appropriate hygiene and health standards.**

**In this session we explore the following concepts:**

- ◆ Maintain appropriate hygiene and health standards.

The vegetative manipulation of most crops is mostly done during winter when there are no fruit on the trees. Poor hygiene and health standards on the farm will not necessarily affect the consumer as in the case of harvesting.

As far as the health of the workers and the plants are concerned, it remains a very important aspect in the whole production program. Vegetative manipulation involves the physical contact with the plant that can easily be contaminated with pathogens which are transmitted by implements or workers. It is a known fact that workers who smoke or handle tobacco products contaminated with the tobacco virus and did not wash their hands, can transmit the virus to tomato plants when handling the plants after a smoke break.

Pruning tools can also transmit bacteria and viruses to healthy plants if tools are not disinfected after pruning a diseased plant. Fungal spores can also be transmitted by clothing and tools that are not regularly cleaned and disinfected.



Please complete Activity 4.

Select at least three different crop species in your area and have group discussions on the following items before submitting a detailed, written report covering the discussed items:

1. The aims and needs for summer and winter pruning.
2. The type of plant material to be removed during summer and winter pruning and other physical manipulation methods.
3. The possible health and hygiene implications as a result of activities discussed in 2 above.



# Glossary

Term	Description
<b>Chemical flower and fruit thinning out</b>	<ul style="list-style-type: none"> <li>means using specific chemical compounds to reduce the number of flowers and young fruit on a tree to the desired number to improve the quality of the eventual crop.</li> </ul>
<b>Cordon</b>	<ul style="list-style-type: none"> <li>means a branch of a tree or vine tied to a horizontal support.</li> </ul>
<b>Creasing control</b>	<ul style="list-style-type: none"> <li>means to control the conditions under which the tree grows or fruit is produced in order to prevent or delay the onset of creasing (tearing the rind) of citrus fruit.</li> </ul>
<b>Delayed harvesting</b>	<ul style="list-style-type: none"> <li>means to hang the fruit on the tree, while retaining the quality until after normal picking time.</li> </ul>
<b>Fruit set improvement</b>	<ul style="list-style-type: none"> <li>means to increase the number of fruit on the tree to improve production.</li> </ul>
<b>Fruit size improvement</b>	<ul style="list-style-type: none"> <li>means applying various techniques in order to improve the size of the marketable fruit.</li> </ul>
<b>Girdling</b>	<ul style="list-style-type: none"> <li>means making a thin cut around the stem, through the bark of a branch in order to temporarily block the downward movement of food (sugars), thus increasing fruit set and/or sugar content of fruit.</li> </ul>
<b>Manipulation</b>	<ul style="list-style-type: none"> <li>means stimulating the plant to change its normal ways of vegetative growth, flower bearing or fruit bearing by applying chemical substances or physical techniques.</li> </ul>
<b>Manual fruit thinning out</b>	<ul style="list-style-type: none"> <li>means manually removing selected fruit from a tree to improve the quality of the remaining fruit.</li> </ul>
<b>Pruning</b>	<ul style="list-style-type: none"> <li>means removing or cutting back of some parts of a plant in order to shape the plant, to improve light penetration or to reduce the number of flower/fruit bearing units.</li> </ul>
<b>Trellising</b>	<ul style="list-style-type: none"> <li>means training a plant to grow onto or along a specific structure that supports the fruit-bearing branches.</li> </ul>

# 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. Discuss the meaning of <i>plant manipulation</i> ?		
2. Discuss the difference and implications of chemical and physical plant manipulation?		
3. Name chemical compounds that can be used for: a) flower manipulation and b) for fruit manipulation as well as the purposes they are used for?		
4. Name and discuss four different types of framework structures.		
5. Draw up management plans to erect these structures.		
6. Write notes on the implementation of these structures.		
7. Write notes on how plants should be trained to make best use of these structures.		
8. As a manager, explain to your group the difference between vegetative and reproductive buds.		
9. Discuss the possible risks of transmitting disease pathogens during physical manipulation.		
10. Chose any crop and write notes on the growth stages when vegetative, flower and fruit manipulation should be done.		

# 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 your 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	<b>116305</b>			
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:



## Bibliography

### ■ Books:

Department of Agriculture, 2007

## Terms & Conditions

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**No user is allowed to sell this material whatsoever.**

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**SOUTH AFRICAN QUALIFICATIONS AUTHORITY  
REGISTERED UNIT STANDARD:**

**Manage plant manipulation methods of an agricultural crop**

SAQA US ID	UNIT STANDARD TITLE		
116305	Manage plant manipulation methods of an agricultural crop		
SGB NAME	NSB	PROVIDER NAME	
SGB Primary Agriculture	NSB 01-Agriculture and Nature Conservation		
FIELD		SUBFIELD	
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 unit standard will be able to implement a plant manipulation management plan using a broad range of techniques. Learners achieving this unit standard will be able to apply their skills and capacity in a variety of production environments and be able to contribute towards overall productivity of a production enterprise by maximizing growth and yield and maintaining high standards of practice.

Learners will gain specific knowledge and skills in plant manipulation processes 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: Monitor and supervise plant manipulation methods of an agricultural crop plant
- 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

**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**

Interpret a plant manipulation management plan.

#### **OUTCOME RANGE**

- Manipulation methods include, but are not limited to framework development, flower and fruit manipulation and pruning, etc.
- Tools include, but are not limited to pruning shears, tie-back material, trellising and spraying equipment etc.

#### **ASSESSMENT CRITERIA**

##### **ASSESSMENT CRITERION 1**

Problems in the use of tools, material appropriate to pre-determined manipulation method on appropriate crop independently are managed and solved.

##### **ASSESSMENT CRITERION 2**

Plant growth is at the correct growth stage according to pre-determined manipulation method under a variety of familiar and unfamiliar contexts.

##### **ASSESSMENT CRITERION 3**

The caring and maintaining of equipment is managed.

#### **SPECIFIC OUTCOME 2**

Create and implement a plant manipulation schedule.

#### **OUTCOME RANGE**

Trellising methods include, but are not limited to Central leader system, Tatura system, two wire system, slanted cap, factory-cap, Façade system, etc.

#### **ASSESSMENT CRITERIA**

##### **ASSESSMENT CRITERION 1**

The manipulation and trellising system is erected appropriate to the crop according to a considerable choice of procedures.

##### **ASSESSMENT CRITERION 2**

Problems related to the manipulation and framework development of the plant are solved according to a considerable range of procedures.

##### **ASSESSMENT CRITERION 3**

The manipulation of, growing points and bearing units appropriate to the crop and the manipulation method under familiar and unfamiliar conditions is managed.

##### **ASSESSMENT CRITERION 4**

The shaping of the plant, under a wide range of conditions, appropriate to the crop and trellising system is managed.

### **SPECIFIC OUTCOME 3**

Supervise the implementation of a plant manipulation schedule.

#### **OUTCOME RANGE**

Flower and fruit manipulation principles include, but are not limited to temperature, daylight length, Bud dormancy breakers, thinning, fruit enlargement, ripening, and preparation quality improvement methods etc - Chemically and physically.

#### **ASSESSMENT CRITERIA**

##### **ASSESSMENT CRITERION 1**

The fruit and flower manipulation is managed.

##### **ASSESSMENT CRITERION 2**

A spraying program for chemically flower/fruit manipulation is established.

##### **ASSESSMENT CRITERION 3**

A program for the physical manipulation on the fruit and flowers is established.

#### **ASSESSMENT CRITERION RANGE**

Physical manipulation includes, but is not limited to thinning, shouldering, brushing, shortening, etc.

### **SPECIFIC OUTCOME 4**

Maintain appropriate hygiene and health standards.

#### **OUTCOME RANGE**

Pruning includes, but is not limited to summer and winter pruning, canopy management etc. appropriate to the crop.

#### **ASSESSMENT CRITERIA**

##### **ASSESSMENT CRITERION 1**

The pruning of plants and the removal of unwanted growth under a variety of familiar and unfamiliar contexts are ensured.

##### **ASSESSMENT CRITERION 2**

The vegetative manipulation and pruning actions are ensured.

#### **ASSESSMENT CRITERION RANGE**

Vegetative manipulation includes but is not limited to winter pruning, summer pruning, canopy management, trellising of shoots, etc.

##### **ASSESSMENT CRITERION 3**

The vegetative manipulation program and actions are established and ensured.

### **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:

- Tools for manipulation of plants.
- Trellising methods.
- Flower manipulation and fruit manipulation methods.
- Pruning methods.
- The principles of manipulation of a plant.
- Names and functions of tools and materials.
- Safe handling procedures of tools and material.
- Maintaining hygienic procedures of tools and material as to prevent spreading of diseases.
- Plant physiology and anatomy.

#### **UNIT STANDARD DEVELOPMENTAL OUTCOME**

N/A

#### **UNIT STANDARD LINKAGES**

N/A

### **Critical Cross-field Outcomes (CCFO):**

#### **UNIT STANDARD CCFO IDENTIFYING**

Problem Solving: Relates to all outcomes.

#### **UNIT STANDARD CCFO WORKING**

Teamwork: Relates to all outcomes.

**UNIT STANDARD CCFO ORGANIZING**

Self-Management: Relates to all outcomes.

**UNIT STANDARD CCFO COLLECTING**

Interpreting Information: Relates to all outcomes.

**UNIT STANDARD CCFO COMMUNICATING**

Communication: Relates to all outcomes.

**UNIT STANDARD CCFO SCIENCE**

Use Science and Technology: Relates to all outcomes.

**UNIT STANDARD CCFO DEMONSTRATING**

The world as a set of related systems: Relates to all outcomes.

**UNIT STANDARD CCFO CONTRIBUTING**

Self-development: Relates to all outcomes.

**UNIT STANDARD ASSESSOR CRITERIA**

N/A

**UNIT STANDARD NOTES**

N/A

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