



Citrus Orchard Foreman Occupational Learning

Work Scenario Guide

C2: Plant Manipulation

Qualification:	110667 – Occupational Certificate: Orchard and Vineyard Foreman
Work Scenario:	C2: Plant Manipulation
Learning Area:	C: Oversee manipulation of citrus trees at various ages
Scenario Description:	You need to manage and oversee plant manipulation activities as they are done to ensure that they are performed properly, efficiently, and effectively.

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1st edition (06/2026)

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Alignment Information

Qualification

The content of this learner guide is aligned to the following occupational qualification:

SAQA QUAL ID	Qualification Title			
110667	Occupational Certificate: Orchard and Vineyard Foreman			
Originator				
Development Quality Partner – AgriSETA				
Primary Or Delegated Quality Assurance Functionary			NQF Sub-Framework	
-			OQSF - Occupational Qualifications Sub-Framework	
QUALIFICATION TYPE		FIELD		SUBFIELD
Occupational Certificate		Field 01 - Agriculture and Nature Conservation		Primary Agriculture
Abet Band	Minimum Credits	Pre-2009 NQF Level	NQF Level	Qual Class
Undefined	147	Not Applicable	NQF Level 04	Regular-ELOAC

Modules

The content of this learner guide is aligned to the following modules of the occupational qualification above.

Module Code	Module Title	Level	Credits
Knowledge Modules			
611202-001-00-KM-01	Plant Structure and Physiology	4	5
611202-001-00-KM-02	Vineyard or Orchard Establishment	3	2
611202-001-00-KM-03	Vineyard or Orchard Manipulation Processes	3	8
611202-001-00-KM-04	Harvesting	3	4
611202-001-00-KM-05	Basic Principles of Plant Nutrition	4	4
611202-001-00-KM-06	Crop Protection	3	3
611202-001-00-KM-07	Assets in Horticultural Production	3	2
611202-001-00-KM-08	Farm Business Management and Farming Process Management	4	8
611202-001-00-KM-09	Human Resource Management and Processes	4	8
611202-001-00-KM-10	Overseeing Farming Resource Utilisation	4	8
Practical Skill Modules			
611202-001-00-PM-01	Organise, Allocate and Monitor Availability and Productive Use of Resources	4	5
611202-001-00-PM-2a	Set Team and Individual Performance Goals to Enhancing Team Performance	4	10
611202-001-00-PM-2b	Control Vineyard or Orchard Practices	4	10

611202-001-00-PM-03	Supply Accurate Daily Orchard or Vineyard and Production Information	4	10
Work Experience Modules			
611202-001-00-WM-01	Vineyard or Orchard Resource Optimisation	4	20
611202-001-00-WM-02	Skilled and Motivated Work Team Output	4	20
611202-001-00-WM-03	Daily Orchard or Vineyard and Production Information Availability	4	20

Learning Outcomes

The content of this learner guide is aligned to the following learning outcomes of the modules above.

Knowledge Topics	
Outcome Code	Module Title
KM-02-KT03	Block establishment
IAC0307	The purpose of vine plant or fruit tree development systems applicable to a given crop is explained
IAC0308	The correct installation of vine plant or fruit tree systems described
KM-03-KT08	Manipulation tools / equipment
IAC0801	The safe use of plant manipulation tools and equipment is described
IAC0802	The sterilisation of tools and equipment during and after plant manipulation tasks is discussed and motivated
IAC0803	The maintenance and storage of tools and equipment is outlined
Practical Skills	

Chapter 1

Plant Manipulation Methods

learning outcomes

The content of this chapter is aimed at helping you to:

- Describe various plant manipulation methods.

1. Plant Manipulation Methods

Plant manipulation methods can be divided into physical and chemical manipulation methods.

2. Physical Plant Manipulation Methods

The methods in this category all make use of physical intervention or manipulation, and include pruning, skirting, girdling, and manual fruit thinning.

Pruning means the physical cutting back of certain parts of the tree. Pruning is used mainly to control the size of citrus trees, to improve their shape, and to improve light interception inside the tree. Pruning can be done by hand or by using machines. Hedging and topping are a mechanical method that uses tractor-mounted machinery. Pruning is discussed in greater detail in Chapter 2.

Skirting means to cut back or remove low hanging branches to a specified height above the soil surface. Skirting is done to prevent fruit and branches from touching the ground and to enhance various cultural practices. Skirting is discussed in greater detail in Chapter 2.

Girdling means making a thin cut through the bark of the tree. Girdling is done to increase fruit set and raise the sugar levels in the fruit. Manual fruit thinning means manually removing selected fruit from a tree to improve the quality of the remainder of the fruit

3. Chemical Plant Manipulation

Chemical plant manipulation is done through the application of chemicals or hormones to achieve the desired results. Chemical plant manipulation includes:

- Fruit set improvement, which is performed to increase the number of fruits on the tree that will reach marketable size and quality
- Chemical fruit thinning, which is performed to reduce the number of fruits on the tree to improve the quality of the remainder of the fruit
- Fruit size enlargement which is performed to make the harvestable fruit larger in size
- Harvest delaying, which is performed to let the fruit stay on the tree for a longer period – while retaining its quality – until after its normal picking time
- Creasing control, which is performed to control the conditions under which the tree grows, or fruit is produced in order to prevent or delay the onset of creasing, which is caused by tearing of the fruit rind

It is important to always operate within the parameters prescribed on the product label. Read the label carefully before using any chemical and only spray according to the recommendations. Take special note of any warnings, precautions, and directions for use.

4. Manipulation and Growth Stages

As you know, citrus trees go through 'growth stages', throughout their lifespans and throughout seasons. Understanding these growth stages is necessary for effective plant manipulation. These growth cycles are influenced by various factors such as climate, soil conditions, water availability, and nutritional status. These growth cycles are discussed in greater detail in the material regarding phenology.

The table on the following page describes various manipulation methods and when they should be practiced in relation with growth stages:

information

Application of Plant Manipulation Methods in Relation to Growth Stages

<i>Manipulation Method</i>	<i>Plant Growth Stages or Timing</i>
Physical Plant Manipulation Methods	
Pruning	• Nursery Trees – Pruning is used for the removal of suckers and is done regularly throughout the year. • Young Trees (<3 years) – Pruning can be done at any time during the year, as the trees are not yet bearing. • Mature, Bearing Trees – Trees are pruned annually, if necessary, preferably in winter just after harvest. Trees can also be pruned up to 4 to 6 weeks after full bloom, but this is less desirable. Return in November/December to check re-growth. • Old Trees in Decline – Pruning is preferably done in winter just after harvest. Return in November / December to check re-growth. • Mechanical Hedging and Topping – This method is used preferably in winter just after harvest. Directly thereafter, windows are pruned by hand. Water shoots and suckers are removed by hand in December or January.
Skirting	Skirting can be done at any time but should not be done too late (after final fruit set) as one would not want to remove growing fruit. The most practical time is after harvest or at the time of pruning.
Girdling	• Fruit Set – Girdling is done two weeks before to two weeks after petal drop to improve fruit set. • Fruit Quality – Girdling is done two to four weeks after the final physiological fruit drop, in late December to early January, to improve fruit quality.
Manual Fruit Thinning	• Velencias and Tomangos – Hand thinning is done on these cultivars when the frame count exceeds seven fruit per 500x500x500mm frame, around four to six weeks after full bloom, November to December. • Clementines – Hand thinning is done on this cultivar when the frame count exceeds fifteen fruit per 300x300x300mm frame, in mid-January in cooler areas after the fruit has reached 20mm.

Chemical Plant Manipulation Methods (Sprays)

Fruit Set Improvement (Gibberellic acid)	In clementines, this spray can be applied from 65 to 75% petal drop to four weeks after 100% petal drop. The timing of the spray affects the response.
Chemical Fruit Thinning	• Oranges, Clementines, Satsumas and Grapefruit (Corasil.E®) – The spray is applied at the end of the physiological fruit drop period at the smallest fruit diameter on the product label. • Oranges, Clementines, Satsumas and Grapefruit (Maxim®) – The spray is applied after the end of the physiological fruit drop period at the smallest fruit diameter on the product label.
Fruit Size Enlargement	• Oranges, Clementines, Satsumas and Grapefruit (Corasil.E®) – The spray is applied at the end of the physiological fruit drop period at the largest fruit diameter on the product label. • Oranges, Clementines, Satsumas and Grapefruit (Maxim®) – The spray is applied after the end of the physiological fruit drop period at the largest fruit diameter on the product label.
Delaying harvesting (Gibberellic acid)	• Grapefruit – The spray is applied at colour break to T5 or up to three weeks thereafter. Average fruit size must not be larger than 89mm. • Lemons – The spray is applied five to eight weeks before the normal picking date.
Creasing control (Gibberellic acid)	• Navels and Valencias – The spray is applied during January to February, or for navels in May when colour is at least T3, or after mid-June for valencias. Concentrations depend on timing.

summary

Chapter 1 – Plant Manipulation Methods

- Plant manipulation methods can be divided into physical and chemical manipulation methods.
- Physical manipulation methods make use of physical intervention or manipulation.
- Physical manipulation methods include pruning, skirting, girdling, and manual fruit thinning.
- Chemical plant manipulation is done through the application of chemicals or hormones.
- Chemical plant manipulation includes fruit set improvement, chemical fruit thinning, fruit size enlargement, delaying harvest and creasing control.
- Pruning is used mainly to control the size of citrus trees, to improve their shape, and to improve light interception inside the tree.
- Skirting is done to prevent fruit and branches from touching the ground and to enhance various cultural practices.
- Girdling is done to increase fruit set and raise the sugar levels in the fruit.
- Fruit thinning means removing selected fruit from a tree to improve the quality of the remainder of the fruit.

assessment activities

- ✓ **Activity P1:** Complete this activity to test your knowledge of plant manipulation methods.

Chapter 2

Pruning

learning outcomes

The content of this chapter is aimed at helping you to:

- Prune citrus trees.

1. Pruning

definition

Pruning

Pruning is a process involving the cutting off or cutting back of plant parts for better canopy shape and more fruitful growth, through the use of more efficient light interception.

Citrus trees grow naturally into a certain shape and in a specific manner, which varies depending on cultivar and rootstock. Branches grow upright from the stem and then bend under its own weight as it becomes bigger to form lateral branches, which then turn down further to form skirts.

New branches sprout on the upper side of the lateral branches and become dominant. The new branches again bend under their own weight as they grow, and the whole process is repeated.

Branches at the top of the tree are more vigorous. Because new branches sprout from the upper part of existing branches, cutting branches from the top of a branch encourages re-growth, while cutting branches from the underside of the branch will not result in re-growth.

If left to its own devices, the tree will end up with a dense outside bearing shell and a dark inside. Fruit is mainly borne on the outside shell, especially toward the top of the tree, with little fruit growing on the inside. Pruning can change the situation and create more light in and through the canopy, allowing for more vigorous growth on the inside of the tree.

One of the biggest mistakes with pruning is to wait too long before you prune. This results in heavy, drastic pruning when the tree is older, which can cause a significant drop in the crop. One must however also be careful of pruning for the sake of pruning.

Pruning must be done with a specific purpose in mind, if and when necessary. Remember trees must never be pruned to upset the balance between fruiting and vegetative growth production. Steady fruiting itself is a useful tree size controlling factor.

Pruning is done for various reasons at various stages in the growth of the tree. The four main stages are:

- Nursery trees
- Young trees (less than three years old)
- Mature, bearing trees
- Old trees in decline

2. Nursery Trees

The pruning of nursery trees are done by experienced nurserymen. The grower specifies what kind of trees is required at delivery, with a choice between trees with formed scaffold branches, whip trees that have had no pruning, or mini trees, being trees that are still very small. Note that a tree that has formed scaffold branches must have a stem thick enough to support them.

The nursery tree must be clean of suckers from ground level past the bud union and up to a specified height (usually 500-600mm) or to the level of the lowest of the potential scaffold branches. Removal of undesirable suckers is an ongoing process and is done frequently.

Suckers are removed when their shoots are small and tender, to ensure that all the growth energy goes into the wanted parts of the small tree. It is important not to remove too much growth, excluding suckers on the stems, from a nursery tree.

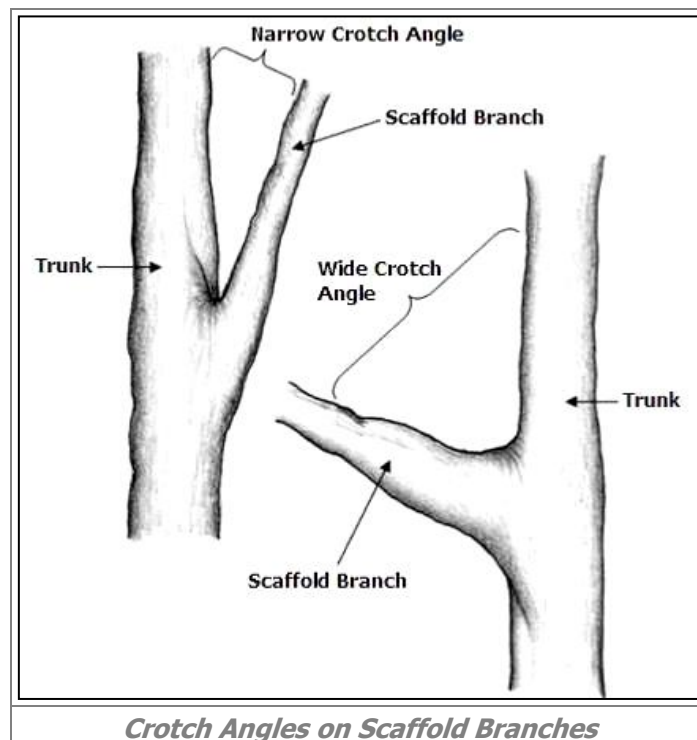
3. Young Trees

During this phase, the growth of the tree is trained slowly. Shaping is a slow, important process, and the ideal shape will not be achieved in the first year.

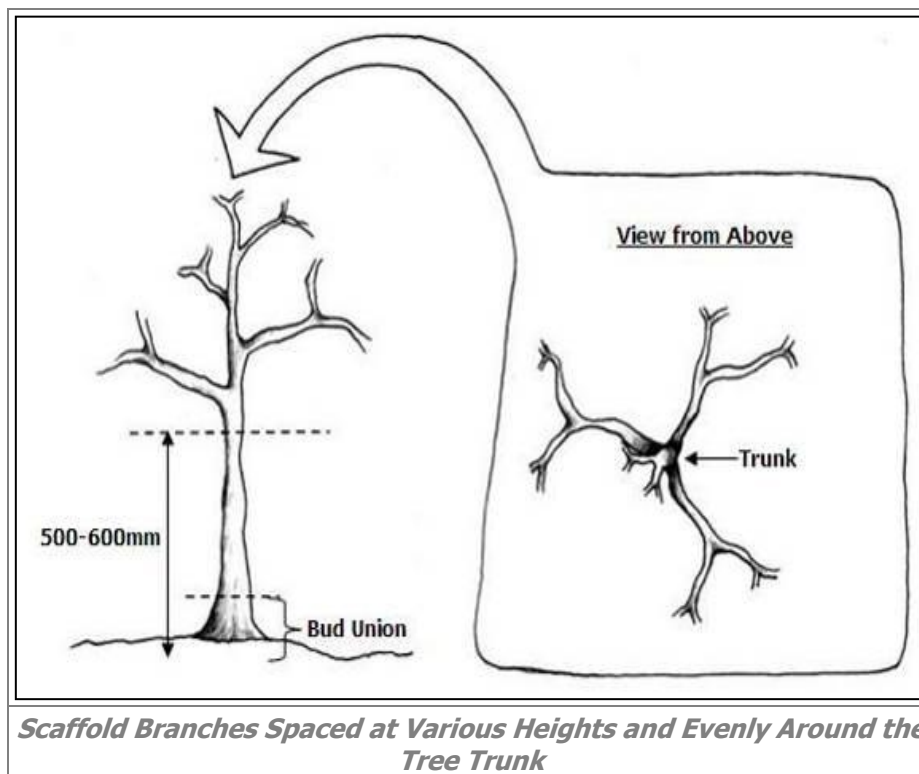
Suckers become less of a problem once trees have been planted in an orchard because stem protectors limit sucker growth, but it is important to remove such growth if and where it is found from ground level to the desired scaffold branch height.

As the size of the tree canopy increases, suckers will also appear less because the stem, or trunk, will be exposed to less light. Light interception is normally not a problem with such young trees. What is important is profuse vegetative growth.

Firstly, four to five well-orientated scaffold branches must be developed. Scaffold branches must preferably have a wide crotch angle in relation to the stem, as these branch attachments are stronger. The figure below shows the difference between a narrow and wide crotch angle.



Scaffold branches must also be well-orientated, meaning that they should be evenly spread around the trunk of the tree, and they should be at various heights. The figure below illustrates these concepts.



Scaffold branches must be spread horizontally and vertically around the trunk in the manner described above for the sake of tree shape, but more importantly for light interception.

A tree requires sunlight for photosynthesis, which is the process through which it produces food, in this case citrus fruit. Through ensuring an optimum spread of scaffold branches while the tree is still young, and through shaping the tree and cutting light windows in the canopy once it is mature, the tree is able to intercept as much light as possible.

4. Mature Trees

After the first two years of the tree's lifespan, the tree shape, determined by the development of suitable scaffold limbs, should be well-developed. The tree shape must now be maintained through careful pruning. At the same time, it is also desirable, within limits, to contain the tree size.

The focus at this growth stage is on:

- Light interception
- Encouraging the growth of fruiting wood
- Simplification of the plumbing

Careful pruning will let in more light, without being detrimental to plant growth. We want as much light throughout the tree as possible. Light is necessary for fruit bud formation. Production of fruiting wood is encouraged by maintaining healthy growing shoots which will bear fruit in the following season.

What does "simplification of the plumbing" mean? The pipe to your kitchen tap is 100m long and 1cm thick. The neighbour's pipe is 10m long and 2cm in diameter. Whose kitchen sink will fill up the fastest when you open the tap? The neighbour's will, because the water has a shorter way to travel, and can travel faster because of the thicker pipe.

Food, or nutrients, and water travel to leaves and fruit through the branches in the same way that water travels through a pipe. Thick, short branches are able to deliver the maximum amount of food and water to the leaves and fruit. "Simplifying the plumbing" means keeping the branches as short and thick as possible.

5. Old Trees

Old trees tend to lack vigour and produce low yields of small fruit size. This can be due to other underlying factors which can cause decline, and these factors must be rectified first.

On old, declining trees there invariably are long, old, thin branches. If these are removed or cut short, the growth of strong, healthy branches will be promoted. Light interception is important, as a lack of light within the canopy invariably is a problem in older trees. Tree size can also be reduced. Vigorous new growth must be encouraged.

6. Mechanical Hedging and Topping

Mechanical hedging and topping are a pruning technique used to cut trees back on both sides of a row at the same time. The advantage of using mechanical hedging and topping is that trees are pruned fast and uniformly.

Hedging is done by cutting just off the vertical, which allows more light penetration over the surface of the tree. It unfortunately does remove some of the fruiting wood but produces more fruiting wood in the next season. For this reason, trees are hedged on one side one year and on the other side the following year.

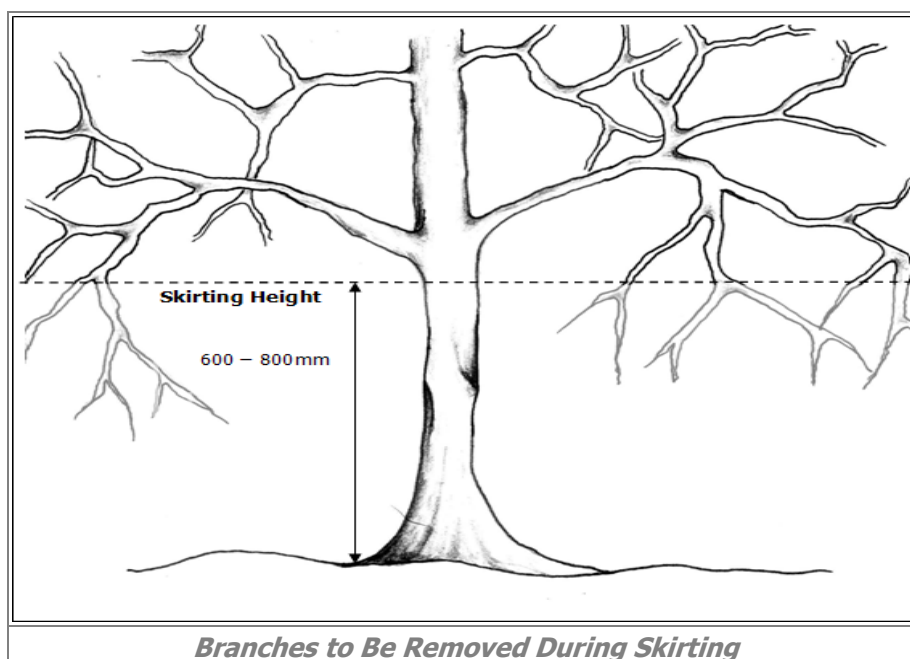
Topping, which is the cutting off of the top of the tree horizontally or at an angle, is done immediately after hedging. Both operations have to be done at the same time in combination to be effective. With this technique effective light penetration through the top of the tree is ensured, resulting in fruit size improvement.

With vigorous trees, this operation is followed up with selective hand pruning at a later stage to control re-growth. Trees are hedged and topped during winter, straight after the harvest. It can be done annually.

7. Skirting

Skirting is done to prevent branches and fruit from touching the ground. Branches hanging below the desired skirting height are cut off, preferably where they join the scaffolds, unless too much material will be removed. The skirting height is normally 600-800mm from the ground.

The figure below is an illustration of skirting. The skirting height is indicated by the thick dotted line. The places where branches should be cut are indicated by thin dotted lines. If the skirting height is close to the juncture with the scaffold branch, the branch can be cut off at the juncture. If the branch on the left in the figure below were to be cut off at the juncture with the scaffold branch, too much vegetation will be lost in the process, and it must therefore be cut at the skirting height.



8. Girdling

Girdling is a thin cut made through the bark of the tree trunk or of a branch. The cut heals again after two or more weeks.

Girdling is done to improve fruit set and to improve sugar levels in the fruit and girdling for these purposes is done at different times during the season. Timing is critical in determining the effect girdling will have on the tree or fruit.

The principles of girdling for fruit set are not quite clear. The girdling cut causes a break in the phloem, which is the food-conducting tissue of a plant. It is thought to cause an increase in the carbohydrates and / or hormone levels that are necessary for fruit set. This has the effect of setting more fruit on the tree. It is unclear what the long-term effects of annual girdling are.

Girdling to improve internal fruit quality is done in summer. The girdling cut temporarily slows down or stops the flow of sugars to the roots and some sugars are redirected to the fruit. This can increase fruit sugar levels. It is unclear what the long-term effects of annual girdling are. Whether girdling for fruit set or fruit quality, it is important not to girdle trees under any form of stress.

summary

Chapter 2 – Pruning

- Pruning is a process involving the cutting off or cutting back of plant parts for better canopy shape and more fruitful growth, through the use of more efficient light interception.
- On nursery trees, suckers are continually removed through pruning.
- The shape and growth of young trees are trained slowly through pruning. A number of scaffold branches that have wide crotch angles and that are evenly spaced around the tree trunk are selected at this stage.
- When pruning mature trees, the focus is on light interception, encouraging the growth of fruiting wood, and simplifying the plumbing of the tree.

- On old trees, long, old, and thin branches are removed from the tree to encourage more vigorous growth.
- Mechanical hedging and topping are used to cut trees on both sides of rows at the same time and to cut the tops of trees to a uniform height.
- Skirting is done to prevent branches and fruit from touching the ground.
- Girdling is a thin cut made through the bark of the tree trunk or of a branch.
- Girdling is done to improve fruit set and to improve sugar levels in the fruit.

assessment activities

- ✓ **Activity P2:** Complete this activity to test your knowledge of pruning.

Chapter 3

Equipment Use and Maintenance

learning outcomes

The content of this chapter is aimed at helping you to:

- Use and maintain manipulation equipment.

1. Equipment Use and Maintenance

Plant manipulation tools and equipment must be used and adjusted according to the specifications of the manufacturer and must be used only for the purpose for which they were designed.

Instructions on chemical labels must be studied carefully and the safety instructions printed on the label must be strictly adhered to. The tools and equipment must be kept in good working order and checked carefully before being used. Blades must be kept sharp and rust-free, and nuts and bolts must be tightened.

Tools and equipment should be stored in a secure storeroom that is dry and free from dust. At the end of the season, tools and equipment must be serviced and oiled to prevent rust. When applying physical plant manipulation methods, such as pruning, workers must be aware of people working on the same tree.

It is better to have only one person at a time working on a tree. All workers must be aware of safety and emergency procedures and must know where the first aid box is kept should it be needed.

2. Shears

The cutting diameter for the specific type of shear must not be exceeded, being branches up to a diameter of 20mm for pruning shears and 30mm for lopping shears. Thicker branches must be cut with a saw. The correct type of shear must also be used for the type of wood that is being cut. Bypass shears are to be used for softer wood, and anvil shears for hard and dead wood.

The blades of shears must always be sharp and sterile and ensure that nuts and bolts are tight. Sterilise the blades before and after use and keep shears lightly oiled when they are not in use. Particular care must be taken when using pneumatic shears and the manufacturer's instructions must be followed carefully.

3. Saws

The bow saw has a replaceable blade, and it must be replaced whenever the blade becomes blunt. The blade must be under tension when cutting. The pruning saw works with a pulling action, as opposed to a forward (pushing) action like other saws. When using a pruning saw, care should be taken not to accidentally cut or damage nearby branches.

Keep blades lightly oiled when not in use and check that blades are tightly attached before being used. Ensure that the blade is sharp and sterilise blades before and after use. Particular care must be taken when using pneumatic saws.

4. Wound Sealant

Various types of wound sealant are commercially available. The sealant is applied over the wound with a brush. Care must be taken to ensure that the sealant is not phytotoxic to citrus. Large, sealed areas exposed to the sun can be painted with non-toxic white paint to prevent sunburn. It is not necessary to seal small wounds. Wear a mask while stirring the sealant, and gloves and goggles when applying it.

5. Carpet / Utility Knife

During girdling, the knife is drawn around the branch or stem, not cutting deeper than the bark thickness. Do not loosen or remove any bark during cutting. These knives have either fixed or retractable replaceable blades. The blades must be replaced when they become blunt. The blades are very sharp and must be used with care. Sterilise blades before and after use.

6. Girdling Saw / Knife

These saws or knives are made specifically for girdling and can be used to girdle a limb (branch or stem) of any diameter. Blades can be plain or serrated (toothed). Some tools have an adjustable guide to control cutting depth, which must never be deeper than the bark thickness.

The tool is pushed into the bark, moved forwards then cut backwards. The cut meets up on the other side of the limb. No bark must be lifted or removed during the process. Sterilise blades before and after use.

7. Girdling Pliers

Girdling pliers have three sharp cutting wheels mounted on adjustable handles in a triangular configuration. Handles can be adjusted to girdle limbs, branches, or stems, from 35mm to 100mm in diameter.

The pliers' jaws are placed around the limb, only light pressure is applied to the handles, and the tool is turned. To complete the girdling action, the tool handle need only be turned one third of the circumference of the limb. The result is a fast, neat cut right around the limb without the operator having to move around the tree.

Where there is excessive fluting of the limb, meaning grooves in the wood, the missed grooves can be cut with a girdling or utility knife. Ensure that the blades on the cutting wheels are kept sharp. Sterilise the wheels before and after use.

8. Skirting Stick

The skirting stick is used to get uniform skirting in an orchard. It can be made from any stick or tubing and is cut to the desired height, usually around 600-800mm. The stick is placed on the ground and any branch hanging lower than the desired height is removed. The unwanted branches are preferably cut off at the juncture with the scaffold branch. Be careful not to cut off too much foliage, especially on young trees.

9. Ladder

Ladders are used to reach high parts of the tree when pruning. They are available in aluminium, fibreglass or wood with different designs and lengths. The most common type has a third leg that is placed on the ground under the tree canopy for stability.

Ensure the ladder is stable before climbing and do not stand on the top rung. The ladder must be long enough for the purpose, so that the worker does not have to reach too far, which may result in a fall. Always face the ladder when ascending and descending.

Ensure that the ladder is kept in good working order, that nuts and bolts are kept tight, and that the rungs are kept clean. Do not place hands on the rungs and do not climb in the tree as this can spread Phytophthora. Ladders must not be painted.

10. Mechanical Hedgers and Toppers

Most models of mechanical hedgers and toppers consist of four to eight large circular, rotating saw blades, mounted on an adjustable arm and driven by the tractor's PTO. Some models can hedge and top simultaneously, but normally these operations are done separately, starting with hedging.

The operator drives at the correct speed, being vigilant of any obstructions or holes in the pathway that may cause the tractor to tilt and cut off too much foliage.

The operator must ensure that all bolts are tight, that blades are sharp and balanced, and the machine is properly mounted on a tractor of the right capacity. Blades must be sterilised before entering a new block of trees or a new orchard and after being used. Sick trees must not be pruned in this way, as certain diseases can be spread via mechanical contact.

Strict safety precautions and safety gear are needed to protect the operator, including a safety cage, earmuffs, gloves, goggles, overalls, and boots. The operation must be carried out when no other production practices are in progress in the block. Suitable warning signs are to be placed at the entrance to the orchard.

11. Mulching Equipment

A mulcher is a tractor-drawn piece of equipment used after pruning. The pruned foliage is raked into the row between the trees and the mulcher then chips or shreds the cuttings into small pieces. This material then acts as mulch in the orchard. Prior to using, ensure that no parts are loose and that the blade is balanced. Nobody must be allowed to walk behind or near the mulcher when in operation.

12. Fruit Measuring Callipers

The average fruit size is determined by selecting 200 fruit at random and measuring the diameter of each using fruit measuring callipers or a measuring card. Select twenty trees at random in a uniform block that has to be sprayed and measure ten fruit per tree. Calculate the average fruit size based on these results.

It is important that only fruit is measured that will not fall off naturally and that all sizes of fruit on the tree, large and small, are measured. Do not measure the small yellow fruit that will fall off. There are different types of callipers available to measure fruit diameter, and they are used in different ways.

- The Vernier calliper has two jaws that are pressed over the fruit and the diameter is read off a sliding scale. It can be used for measuring fruit up to 150mm in diameter but is more suited to measuring small fruit
- A card calliper has holes of specific sizes. The fruit is passed through the matching holes. The range is 12 to 26mm, with increments of 2mm diameters
- Grading rings are plastic rings with specific diameters. The fruit is passed through a ring of the suitable size. The range is from 13 to 92mm diameter
- A fruit strap calliper is used to measure large fruit nearing or at maturity. It is accurate from about 50mm diameter and larger

When using a calliper, do not squeeze the fruit too tight or force the fruit through a particular hole. This will damage the fruit skin, and can give inaccurate measurements.

13. Tractors and Large Equipment

Using tractors and large equipment is a specialised task. Only workers that are trained in the use, maintenance and safety aspects of such machinery should be allowed to operate them. Always operate the equipment according to the manufacturer's specifications, such as maintaining correct gear and tractor speed during spraying. The operator must take full responsibility for the equipment. Calibrate and use the right nozzles on spraying equipment.

14. Equipment Sterilisation

All blades on plant manipulation equipment must be sterilised prior to use. This is to prevent the spread of citrus viroids, such as exocortis which is highly mechanically transmissible. The virus is especially prevalent in older trees of certain cultivars on tolerant rootstocks, which was used before inspections by the S.A. Citrus Improvement Programme started.

It is impractical to sterilise equipment after each tree when pruning a large number of trees. It is more practical to sterilise the tools between each homogenous block or orchard. Equipment must however be sterilised continuously if sick trees are being pruned.

A good disinfectant for sterilising tool and equipment is a 20% solution of household bleach (20ml bleach added to 80ml water) with the active ingredient 3.5% sodium hypochlorite, such as Jik®. Beware of cheaper brands that may not have the desired active ingredient. This sterilising mixture is corrosive and causes blades to rust. The following solution has given good results for sterilising and preventing rust of blades: 30 parts Jik®, 25 parts vinegar, 2 parts light spray oil and 75 parts water.

It is preferable to spray blades with the sterilising solution, but it can also be dipped in the solution or wiped with a cloth that has been dipped in the solution. Make up a fresh solution daily and keep it in a dark container, out of direct sunlight.

Do not let the solution get into contact with open wounds, eyes, or clothing. Keep all equipment and sterilising solutions out of reach of children and animals.

summary

Chapter 3 – Equipment Use and Maintenance

- Plant manipulation tools and equipment must only be used according to the specifications of the manufacturer.
- Tools and equipment should be stored in a secure storeroom that is dry and free from dust.
- At the end of the season, tools and equipment must be serviced and oiled to prevent rust.
- The blades of shears must always be sharp and sterile and ensure that nuts and bolts are tight.
- Woun sealant is applied over wounds with a brush.
- The skirting stick is used to get uniform skirting in an orchard.
- Ladders are used to reach higher into trees.
- Fruit callipers are used to measure fruit size.
- Sterilisation is performed to prevent the spread of citrus pathogens.

assessment activities

- ✓ **Activity P3:** Complete this activity to test your knowledge of manipulation equipment use and maintenance.
- ✓ **Activity F1:** Complete this activity to test your knowledge of the entire module.