Citrus Orchard Foreman Occupational Learning

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Study Guide

KM-03:
Vineyard or Orchard Manipulation Processes

Qualification:	110667 – Occupational Certificate: Orchard and Vineyard Foreman		
Module No.:	611202001-KM-03		
Module Title:	Vineyard or orchard manipulation processes		
NQF Level:	3	**Credits:**	8

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Qualification Information

The content of this study 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

Knowledge Module

The content of this learner guide is aligned to the following module 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

Knowledge Topics, Topic Elements, and IACs

The content of this study guide is aligned to the following knowledge topics, topic elements, and internal assessment criteria of the module above.

Knowledge Topics, Topic Elements, and IACs	
Code	**Title**
KM-03-KT01	**Framework Development (13%, 1.04 credits)**
KT0101	Vine plant / fruit tree development methods applicable to specific crop
IAC0101	The principles of developing vine plants and fruit trees applicable to the growth of the crop are described
IAC0102	Free standing systems are compared to trellised systems in terms of advantages, disadvantages and applicability
IAC0103	The adaptation of the framework to the bearing ('dra wyse') of the crop is outlined
KM-03-KT02	**Pruning (13%, 1.04 credits)**
KT0201	Objectives and principles
KT0202	Types of pruning and pruning systems
IAC0201	The main objective of pruning is explained
IAC0202	The main principles of pruning is discussed
IAC0203	The distinction between winter and summer pruning is discussed
IAC0204	The relevant pruning systems for specific crops or cultivars are explained
KM-03-KT03	**Canopy management / foliage management (13%, 1.04 credits)**
KT0301	Objectives and principles
KT0302	Types of canopy management practices
IAC0301	The main objective of canopy management is explained
IAC0302	The main principles of canopy management is discussed
IAC0303	The concept of foliage management is defined
IAC0304	The reason, process and timing of suckering are explained
IAC0305	The reason, process and timing of shoot positioning are explained
IAC0306	The reason, process and timing of lateral shoot removal are explained
IAC0307	The reason, process and timing of leaf removal are explained
KM-03-KT04	**Crop control (13%, 1.04 credits)**
KT0401	Objectives and principles
KT0402	Crop control practices
IAC0401	The main objective of crop control is explained
IAC0402	The main principles of crop control are discussed
IAC0403	The reason, process and timing of flower and fruit thinning are explained
IAC0404	The reason, process and timing of physical, chemical and mechanical crop control practices are explained
KM-03-KT05	**Chemical manipulation (12%, 0.96 credits)**
KT0501	Dormancy management
KT0502	Thinning
KT0503	Fruit size improvement
KT0504	Quality improvement

IAC0501	The reason, process and timing of dormancy management are explained
IAC0502	The reason, process and timing of thinning are explained
IAC0503	The reason, process and timing of fruit size improvement are explained
IAC0504	The reason, process and timing of quality improvement are explained
KM-03-KT06	**The reason, process and timing of thinning are explained (12%, 0.96 credits)**
KT0601	Colour improvement
IAC0601	The reason, process and timing of colour improvement are explained
KM-03-KT07	**Physical manipulation (12%, 0.96 credits)**
KT0701	Shoot positioning (bending down of shoots)
KT0702	Girdling
IAC0701	The underlying principle of shoot positioning is discussed
IAC0702	The reason, process and timing of shoot positioning are explained
IAC0703	The underlying principle of girdling is discussed
IAC0704	The reason, process and timing of girdling are explained
KM-03-KT08	**Manipulation tools / equipment (12%, 0.96 credits)**
KT0801	Handling procedures for tools and material
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

KM-03-KT01:
Framework Development
(13%, 1.04 credits)

Topic Elements

The content of this chapter covers the following topic elements:

- KT0101: Vine plant / fruit tree development methods applicable to specific crop

1. KT0101: Vine Plant / Fruit Tree Development Methods Applicable to Specific Crop

IAC0101: The principles of developing vine plants and fruit trees applicable to the growth of the crop are described

IAC0102: Free standing systems are compared to trellised systems in terms of advantages, disadvantages and applicability

IAC0103: The adaptation of the framework to the bearing ('dra wyse ') of the crop is outlined

- Free-standing tree systems refer to citrus trees that are not physically supported by trellises or structures.
- Free-standing trees grow naturally and require more space between trees for canopy growth.
- These extra space requirements lead to more spacious orchard layouts, and more land may be required for the same tree density.
- Free-standing systems can make production activities such as harvesting, pruning, and pest management more challenging due to larger canopies and irregular spacing.
- Trellised tree systems refer to citrus trees that are grown using support structures (trellises or wire frames) to guide tree growth.
- Trellised systems allow for closer tree spacing, increasing tree density, and maximising land use.
- Trellised systems also allow for more uniform and orderly orchard layout.
- The uniform layout allows for easier management due to controlled canopy growth and consistent spacing between trees.
- The uniform layout also allows for easier movement throughout the orchard for vehicles, machinery, and workers.
- The uniform layout also makes production activities such as pruning, harvesting, and pest management more straightforward.
- The framework (trellis systems) must be adapted as the tree grows, depending on the desired bearing of the fruit.

self-assessment

KT0101: Vine Plant / Fruit Tree Development Methods Applicable to Specific Crop

Can I?	Y/N
Can I explain the differences between free-standing and trellised tree systems, and how they affect production planning and practices?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0101	The principles of developing vine plants and fruit trees applicable to the growth of the crop are described	B6, B7, C1, C2, D2
IAC0102	Free standing systems are compared to trellised systems in terms of advantages, disadvantages and applicability	B6, B7, C1, C2, D2
IAC0103	The adaptation of the framework to the bearing ('dra wyse') of the crop is outlined	B6, B7, C1, C2, D2

KM-03-KT02:
Pruning
(13%, 1.04 credits)

Topic Elements

The content of this chapter covers the following topic elements:

- KT0201: Objectives and principles
- KT0202: Types of pruning and pruning systems

1. KT0201: Objectives and Principles

IAC0201: The main objective of pruning is explained

IAC0202: The main principles of pruning is discussed

- If citrus trees are allowed to grow naturally, they tend to develop dense canopies that limit light penetration and air movement.
- The lack of light can lead to twig dieback, weak branches, and poor fruit quality.
- The lack of ventilation creates conditions that encourage pathogen growth and limit the effectiveness of production practices such as PPP applications.
- Pruning is performed to improve light penetration, maintain optimal tree size and shape, maintain general tree health, and facilitate production activities.
- Most flowers and fruit found on terminally positioned branches, which are new branches formed during the previous season's vegetative flush.
- Pruning encourages the development of new terminal branches in the following season.
- This new growth where fruit and flowers will form next year is referred to as 'new bearing sites.
- Trees bearing heavy crops often have reduced vegetative flush, due to the fruit draining the tree's resources, limiting the energy available for new growth.
- Reduced vegetative flush leads to fewer flowers, and thus a poorer crop, resulting in "alternate bearing".
- Alternate bearing is a pattern of heavy yields followed by poor yields in following seasons, and vice versa.
- Pruning can help to prevent alternate bearing by balancing vegetative vigour and fruitfulness.
- Pruning can also improve blossom quality by encouraging green blossoms that produce fruit which stays on the tree.
- Improved light penetration increases sprouting, while improving flower and bearing wood quality.

- Good quality bearing wood is vigorous, with new shoots close to scaffold branches that receive adequate light.
- Better light penetration also facilitates easier harvesting, as the fruit will be lower down in the tree, and more uniform in quality, which means less selective picking is necessary.
- Tree size and shape can be controlled through pruning, but spacing at planting also plays a major role in final size, with closer spacing requiring more frequent pruning to prevent overcrowding.
- For optimum light interception, the general rule of thumb for pruning tree height is that the tree height must not exceed twice the length of the in-row spacing.
- Pruning can keep trees in a continual growth phase, as opposed to a devitalised or declining state, keeping trees continually productive and vigorous.
- Trees must never be pruned heavily, as the trees' carbohydrates (energy reserves) are stored in the leaves, twigs, and branches.
- These carbohydrates are necessary for good growth and fruit development, and excessive pruning removes this nutrient source.
- Pruning influences hormonal balance by interrupting apical dominance, where the main shoot or branch suppresses side bud growth.
- Pruning to remove the apical (main) tip allows dormant buds on the side to sprout and create new shoots.
- Effective pruning improves flower quality, reduces energy spent on weak flowers, minimises fruit drop, and supports higher yields of larger fruit.
- Pruned trees develop stronger branch frameworks that can support heavy foliage and fruit loads, resist breakage, and carry fewer diseased or poor-quality branches.
- Production practices such as harvesting and agrochemical application are easier with pruned trees, as canopies are controlled to keep access roads open and reduce equipment damage.
- Pruning enhances spray penetration and coverage, ensuring optimal use of agrochemicals, healthier trees, and reduced waste of inputs.

self-assessment

KT0201: Objectives and Principles

Can I?	Y/N
Can I describe the importance of sunlight and ventilation for citrus trees?	
Can I explain how canopy management can improve sunlight penetration and ventilation?	
Can I prune trees to encourage the development of new growth?	
Can I explain the concept of alternate bearing?	
Can I describe the advantages of pruning in terms of flower and fruit development?	
Can I explain the risks of over-pruning?	
Can I prune to facilitate other production practices?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0201	The main objective of pruning is explained	A5, B7, C1, C2, D2
IAC0202	The main principles of pruning is discussed	A5, B7, C1, C2, D2

2. KT0202: Types of Pruning and Pruning Systems

IAC0203: The distinction between winter and summer pruning is discussed

- Pruning varies through the seasons in terms of frequency, method, and objectives, with the main distinction being between winter pruning and summer pruning.
- Winter pruning is carried out while citrus trees are dormant, with the goal of stimulating strong new growth in spring.
- During dormancy, pruning allows trees to conserve energy that would otherwise go to maintaining unnecessary branches and redirect it toward new shoots and branches in spring.
- Because dormant trees during winter are less sensitive to stress, they can handle heavier pruning, making it the ideal time for major cuts and restructuring of tree shape or size.
- Winter pruning also reduces the risk of sap loss and pest infestation, making it a good opportunity to remove dead, diseased, or overlapping branches.
- Summer pruning is conducted during the tree's active growth phase.
- Summer pruning is mainly focused on controlling excessive vegetative growth, which redirects the tree's energy toward fruit production rather than unnecessary leaf growth.
- Only light pruning should be performed in summer, as heavy pruning during active growth can stress the trees.
- Heavy pruning can also increase vulnerability to sun damage and create openings for pests and infections.
- Light summer pruning can also improve light distribution within the canopy, ensuring fruit receives balanced sunlight exposure for optimal development and ripening.

IAC0204: The relevant pruning systems for specific crops or cultivars are explained

- Each citrus cultivar has unique growth habits, fruit-bearing characteristics, and specific requirements.
- Pruning systems must be tailored to suit individual citrus crops or cultivars for optimal productivity and fruit quality.
- Sweet oranges, such as Valencia and Navel, tend to develop dense canopies, and require heavy pruning, especially during dormancy.
- Sweet orange trees should be pruned to open up the tree's inner canopy to light and air circulation, promoting fruit colouration and reducing pest infestations.
- Dead, diseased, and crossing branches on sweet orange trees should be removed to ensure that the tree's energy is directed towards healthy fruit-bearing branches.
- Mandarins are typically smaller trees that grow fairly upright, and it is best to prune them lightly to moderately.
- Mandarins should not be heavily pruned, but regular thinning of the canopy is advised to ensure sunlight penetration without negatively affecting fruit production.
- Lemons are vigorous growers and easily develop into large trees, so they require regular and structured pruning to facilitate harvesting and maintain tree size.

- Lemons require heavy winter pruning to manage tree size, and light summer pruning to manage tree shape.
- Removing water shoots on lemon trees is essential to prevent energy wastage.
- Grapefruits have a spreading growth habit, and their branches tend to droop as the heavy fruits develop.
- Grapefruit pruning should focus on providing support and reducing the weight on the outer branches.
- Grapefruits require light pruning, especially on the outer canopy, to reduce branch breakage.
- Lower branches on grapefruit trees that touch the ground should also be removed to prevent pest entry.

self-assessment

KT0202: Types of Pruning and Pruning Systems

Can I?	Y/N
Can I explain the differences between summer and winter pruning?	
Can I describe the dormancy period and its function in tree development?	
Can I describe the different pruning practices of specific cultivars?	
Can I effectively and properly prune the cultivar(s) on my farm?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0203	The distinction between winter and summer pruning is discussed	A5, B7, C1, C2, D2
IAC0204	The relevant pruning systems for specific crops or cultivars are explained	A5, B7, C1, C2, D2

KM-03-KT03: Canopy Management / Foliage Management (13%, 1.04 credits)

Topic Elements

The content of this chapter covers the following topic elements:

- KT0301: Objectives and principles
- KT0302: Types of canopy management practices

1. KT0301: Objectives and Principles

IAC0301: The main objective of canopy management is explained

IAC0302: The main principles of canopy management is discussed

IAC0303: The concept of foliage management is defined

- The canopy, made up of the tree's leaves, branches, and fruit, is the powerhouse of a citrus tree.
- The canopy captures sunlight, facilitates photosynthesis, and is where fruit grows.
- Canopy management, also called foliage management, focuses on maintaining a balance between vegetative growth (leaves and branches) and reproductive growth (flowers and fruits).
- An imbalance between vegetative and reproductive growth can negatively affect trees.
- Trees with excessive vegetative growth may have reduced fruit yields, and trees with excessive reproductive growth focused only on fruiting might suffer in vitality.
- Canopy management also focuses on light penetration, allowing sunlight to reach all parts of the tree.
- A well-managed canopy ensures that even the innermost leaves receive their share of sunlight, promoting uniform growth and fruit development.
- Dense, unmanaged canopies can create dark, moist environments, which are very suited to the growth of fungal diseases and pests.
- Proper canopy management promotes air circulation, reducing the chances of disease outbreaks, and creating a healthier environment for the tree.
- Well-managed canopies also make fruit more accessible during harvest, reducing fruit damage, increasing fruit quality, and ultimately, revenue.
- Canopy management also prevents a tree from becoming overloaded with more fruit and vegetation than it can support, preventing breakage from environmental factors like wind.

- The canopy should be managed with production practices in mind, including pest control, disease management, and harvesting.

self-assessment

KT0301: Objectives and Principles

Can I?	Y/N
Can I describe the tree's canopy?	
Can I explain the difference between vegetative and reproductive growth?	
Can I describe how vegetative growth affects fruit development?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0301	The main objective of canopy management is explained	A5, B7, C1, C2, D2
IAC0302	The main principles of canopy management is discussed	A5, B7, C1, C2, D2
IAC0303	The concept of foliage management is defined	A5, B7, C1, C2, D2

2. KT0302: Types of Canopy Management Practices

IAC0304: The reason, process and timing of suckering are explained

- Suckers are vigorous shoots that grow from the base of the tree or from its roots.
- While suckers may appear green and lively, they siphon away vital nutrients and energy from the main tree, often at the expense of fruit production.
- Suckers must be removed to direct the tree's resources towards the main canopy, promoting better fruit development, overall health, and maintaining the desired tree structure.
- Suckering can be performed throughout the year, but is most important during the trees' dormant phase, typically in winter.
- Conducting suckering during dormancy ensures minimal stress to the tree and reduces the risk of disease transmission, as many pathogens are less active during this period.
- However, given the aggressive nature of some suckers, suckering should still be performed whenever needed, even outside of the primary suckering season.
- The procedure of suckering is as follows:
  1. Regularly inspect the bases and roots of trees in the orchard for suckers.
  2. Sharpen (if needed) and disinfect pruning shears and wear protective gloves.
  3. Grip the sucker near its base.
  4. Make a clean cut with the pruning shears as close to the main trunk or root as possible, without harming the main stem or nearby roots in the process.
  5. Collect the removed suckers and dispose of them away from the orchard to prevent any potential disease spread or pest infestations.
  6. After the suckering, monitor the areas the suckers were removed from for any signs of disease or pest infestations.

IAC0305: The reason, process and timing of shoot positioning are explained

- Shoot positioning is the practice of adjusting the orientation of new shoots to ensure optimal light exposure and air circulation.
- Shoot positioning is performed for numerous reasons, including optimising light exposure, enhancing air circulation, and providing structural balance.
- Shoot positioning is optimally performed during the active growth phase, as the shoots are still flexible and can be adjusted without causing damage.
- The trees' growth should be regularly monitored during this period, and shoots should be positioned as needed.
- The procedure of shoot positioning is as follows:
  1. Regularly inspect the canopies of trees in the orchard to identify shoots that might be growing inwards or causing overcrowding particularly after periods of rapid growth.
  2. Gently bend the soft, green shoots to the desired position, avoiding snapping or severely bending the shoots.
  3. For more stubborn shoots, use plant ties or clips to keep them in place.
  4. Ensure that plant ties or clips are not too tight, allowing room for the shoot to grow.

5. Trees must be regularly checked and adjusted to ensure that shoots do not revert to their original position or to adjust new shoots that have emerged.

IAC0306: The reason, process and timing of lateral shoot removal are explained

- Lateral shoots, often termed 'side shoots', grow outwards from the main stem or branch.
- Some lateral growth is healthy, but excessive lateral shoots can be counterproductive, so lateral shoots should be regularly removed.
- Lateral shoots can divert essential resources away from the main branches and fruit-bearing areas, potentially impacting fruit yield and quality.
- Lateral growth can cause overcrowding, and thus a dense canopy, restricting light penetration and air circulation.
- Lateral growth can hinder the ease of fruit picking and other production practices.
- Lateral shoots are optimally removed during the dormant season, which ensures minimal stress to the tree and reduced sap flow from the cuts.
- Lateral shoots that are diseased, damaged, or pose an immediate threat to the tree's health should be removed immediately irrespective of the season.
- The procedure of lateral shoot removal is as follows:
  1. Regularly inspect the canopies of trees in the orchard to identify and mark excessive or undesirably placed lateral shoots, particularly those that are overshadowing fruit-bearing branches or creating congestion.
  2. Sharpen (if needed) and disinfect pruning shears or secateurs and wear protective gloves.
  3. Make a clean cut angled cut close to the main branch, without damaging the bark or main branch.
  4. Collect the removed shoots and dispose of them away from the orchard to prevent any potential disease spread or pest infestations.
  5. After the removal, monitor the pruned areas for any signs of disease or pest infestations.

IAC0307: The reason, process and timing of leaf removal are explained

- Leaves are the primary sites for photosynthesis, and removing leaves may seem counterintuitive when trying to maintain tree health.
- However, leaf removal can be beneficial, by aiding in disease control, improving light penetration and air circulation, and redirecting energy to fruit production.
- Leaves should optimally be removed in late spring to early summer, just before or during the initial stages of fruit ripening, providing fruits adequate sunlight for optimal colour development.
- Leaves that show signs of disease or infestation should be removed immediately irrespective of the season.
- The procedure of leaf removal is as follows:
  1. Identify which leaves to remove by looking for signs of disease or yellowing, or those leaves overshadowing fruit clusters.

2. Sharpen (if needed) and disinfect pruning shears or clippers and wear protective gloves.
3. Hold the targeted leaf by its stalk, and make a clean cut close to the branch, without damaging adjoining leaves or fruits.
4. Collect the removed leaves and dispose of them away from the orchard to prevent any potential disease spread or pest infestations.
5. After the removal, monitor the pruned areas for any signs of disease or pest infestations.

self-assessment

KT0302: Types of Canopy Management Practices

Can I?	Y/N
Can I explain why suckers need to be removed?	
Can I safely and effectively remove suckers?	
Can I explain why shoots need to be positioned?	
Can I safely and effectively position shoots?	
Can I explain why lateral shoots need to be removed?	
Can I safely and effectively remove lateral shoots?	
Can I explain why some leaves need to be removed?	
Can I safely and effectively remove leaves?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0304	The reason, process and timing of suckering are explained	B7, C1, C2, D2, D4
IAC0305	The reason, process and timing of shoot positioning are explained	B7, C1, C2, D2, D4
IAC0306	The reason, process and timing of lateral shoot removal are explained	B7, C1, C2, D2, D4
IAC0307	The reason, process and timing of leaf removal are explained	B7, C1, C2, D2, D4

KM-03-KT04:
Crop Control
(13%, 1.04 credits)

Topic Elements

The content of this chapter covers the following topic elements:

- KT0401: Objectives and principles
- KT0402: Crop control practices

1. KT0401: Objectives and Principles

IAC0401: The main objective of crop control is explained

- Crop control is a systematic approach to orchard management that aims at regulating and optimising fruit yield and quality by balancing vegetative growth and fruit production.
- Crop control involves a delicate balancing act of ensuring that the trees produce consistently high-quality fruits without compromising their health or resource availability.
- Crop control techniques include pruning, fruit thinning, nutrient management, and water regulation, among others.
- Every piece of fruit must meet stringent standards, including both external and internal quality.
- Consistent quality builds trust with consumers and ensures a sustainable market presence.
- Farmers should always aim for regular and abundant yield, by managing the natural tendency of citrus trees towards alternate bearing.
- Crop control aims to avoid alternate bearing by maintaining consistent yields of high-quality fruit.
- Trees, like any organism, have a fixed amount of energy and nutrients at their disposal.
- Bearing an excessive yield of fruit, spreads these limited reserves too thinly, potentially leading to smaller, lower quality fruit.
- Crop control aims to maintain an optimal number of fruits, not too many or too few, guaranteeing resource allocation that benefits both the tree and the farmer.
- Crop control utilises canopy management to avoid overly dense canopies that create dark, moist environments which are favourable for pests and fungal diseases.

IAC0402: The main principles of crop control are discussed

- The principles of crop control include canopy management, nutrition, water management, and monitoring.

- Every cut made during pruning sends signals to the tree, and removing older, non-productive branches invigorates the tree, leading to fresh vegetative growth.
- Pruning too much can reduce the number of fruit-bearing branches for the next season and pruning too little might result in an excessive yield of lower quality fruit.
- Proper nutrition is vital for trees, and nutrition management is a core principle of crop control.
- Understanding the soil's nutrient profile, supplementing where needed, and ensuring the leaves have the necessary nutrients, are all vital for producing high-quality fruit.
- Water management should be focused on quantity, timing, and distribution of irrigation.
- Over-watering, especially during fruit development, can lead to fruit drop, and under-watering can cause water stress, which reduces fruit size and quality.
- Trees and the orchard environment must be regularly monitored to ensure that small issues are addressed before they escalate into significant challenges.

self-assessment

KT0401: Objectives and Principles

Can I?	Y/N
Can I describe the concept of crop control?	
Can I describe the concept of fruit quality?	
Can I explain why crop control is necessary?	
Can I implement pruning and thinning when necessary?	
Can I implement canopy, nutrition and water management practices as part of crop control?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0401	The main objective of crop control is explained	A5, C1, C2, D1, D2
IAC0402	The main principles of crop control are discussed	A5, C1, C2, D1, D2

2. KT0402: Crop Control Practices

IAC0403: The reason, process and timing of flower and fruit thinning are explained

- For fruit to reach optimum size, trees need a minimum leaf-to-fruit ratio.
- If this ratio is too low, there are not enough nutrients in the tree to maintain fruit growth to maturity, resulting in a crop of small fruit.
- If the ratio is too high, the canopy will be too dense.
- The ideal ratio differs from variety to variety as well as from region to region.
- The best way to maintain this ratio at the right level is to thin trees.
- Thinning refers to two separate but related practices, namely fruit and flower thinning, both of which have to do with removal.
- Each flower on a citrus tree is a potential fruit, but allowing all flowers to develop into fruits can strain the tree's resources.
- Flower thinning is the deliberate removal of some flower clusters or blossoms from a citrus tree during its blooming phase.
- Removing flowers allows the tree to better allocate nutrients, water, and energy to the remaining blossoms, ensuring better fruit set and development.
- Flower thinning can also reduce the risk of alternate bearing by maintaining a more consistent potential yield year after year.
- Flower thinning can also prevent overburdening a tree with too many fruits, which can lead to branch breakages and long-term structural damage.
- The optimal period for flower thinning in citrus orchards is shortly after the full bloom stage.
- Thinning during this period ensures that the tree's energy is not excessively spent on flowers that will be removed and can instead be channelled to the remaining blossoms.
- The procedure of flower thinning is as follows:
    1. Regularly inspect trees during the blossoming period to identify clusters that may be too dense or blossoms that seem weaker and less likely to produce quality fruits.
    2. Sharpen (if needed) and disinfect pruning shears and wear protective gloves.
    3. Carefully remove the selected flowers by cleanly cutting their stems without damaging adjacent blossoms or young shoots.
    4. In certain scenarios, growth regulators can be employed to reduce flower set, but this should be done sparingly, while adhering carefully to guidelines, and considering potential ecological impacts.
    5. After thinning, monitor the trees' health, ensuring that the remaining flowers are developing adequately and that the trees are not under undue stress.
- Fruit thinning is the deliberate removal of some of the developing fruits from a citrus tree.
- Fruit thinning is performed for the same reasons as flower thinning, namely, optimising resource usage, preventing damage, improving sunlight penetration, and mitigating alternate bearing.

- Below the age of three years, all fruit is removed from trees to allow them to use all of their energy for vegetative growth.
- If fruit on small trees is allowed to mature, the tree may be pulled over or damaged from the weight.
- Fruit on young trees is also not of a very good quality and is therefore not worth harvesting.
- The fruit on young trees is thinned by hand after the November drop, meaning the final physiological fruit drop.
- On mature trees, fruit thinning is performed to remove smaller fruit so that the trees can use their available reserves to maintain the growth of the larger fruit.
- Fruit thinning also assists in improving fruit size uniformity.
- Fruit thinning is only performed if the leaf to fruit ratio shows that the fruit load of the tree is excessive.
- Fruit thinning is optimally performed during the early developmental stages of the fruit.
- Thinning fruit during this period ensures the remaining fruits have sufficient time to utilise the freed-up resources, resulting in optimal growth and maturation.
- The decision on when to thin is based on the number of fruits at the end of the physiological drop, and thus the number of small fruitlets that should be removed.
- The more fruit that must be removed, the earlier the application date should be.
- Fruit thinning is generally performed early in cooler areas, with small fruit cultivars, with trees in heavy soils, and in orchards with high yield potential.
- Fruit thinning is performed later with medium sized fruit, or with a low yield coupled with small fruit.
- Fruit thinning is divided into two different practices, namely manual fruit thinning and chemical fruit thinning.
- Manual fruit thinning involves physically (manually) removing the fruit from the tree, usually by hand or using clippers.
- Manual fruit thinning can be done a little later than chemical thinning.
- Manual fruit thinning gives the opportunity to remove blemished and malformed fruit more selectively before harvest, improving the pack-out percentage.
- Manual fruit thinning is usually not practical or economical to perform on a large scale due to being very labour intensive.
- The procedure of manual fruit thinning is as follows:
    1. Calculate the number of fruits that must be removed.
    2. Sharpen (if needed) and disinfect pruning shears and wear protective gloves.
    3. Remove any fruit that are blemished and / or malformed by cutting the stem cleanly, close to the fruit.
    4. Remove any fruit that are smaller than a specified diameter in the same manner as before.
    5. Remove fruit from clusters until there are only one or two left, in the same manner as before, until the required number of fruits have been removed.

- Chemical fruit thinning involves applying agrochemicals to trees to reduce the number of developing fruits.
- Chemical fruit thinning is used together with and as a substitute for manual fruit thinning.
- Chemical fruit thinning is performed for the same reasons as manual fruit thinning.
- Applying fruit thinning agrochemicals just after the final physiological fruit drop causes small fruit to abscise or drop off, allowing the tree to retain only the fruit that it can successfully grow to the required size.
- Various products are used for chemical fruit thinning, depending on the variety of citrus, and are usually applied in a medium cover spray in the prescribed concentration.
- Farmers should consult with chemical suppliers, other farmers, and industry experts for advice on which agrochemicals to use and how they should be applied.

IAC0404: The reason, process and timing of physical, chemical and mechanical crop control practices are explained

- The practices that make up crop control are divided into physical, chemical, and mechanical crop control practices.
- Physical crop control refers to the direct, manual practices implemented in the orchard environment or on the citrus trees themselves.
- Physical crop control includes using supportive or protective structures, thinning, pruning, and mulching.
- Supportive or protective structures (such as stakes or hail netting) are used to create growing conditions that protect from harsh weather such as hail or heavy wind.
- These structures should be set up in anticipation of the specific threats they aim to mitigate, such as setting up hail netting well before the hail season usually begins.
- Mulching refers to the application of organic or inorganic materials around the base of the trees to help with moisture retention and pest and weed control.
- Mulching is optimally performed at the beginning of the growing season but can also be performed as necessary throughout the year.
- Chemical crop control refers to the use of agrochemicals in the orchard environment or on the citrus trees themselves.
- Chemical crop control can be performed to manage pests, diseases, and weeds, regulate growth, and enhance fruit production and quality.
- Chemical crop control practices generally involve a process of assessment, chemical selection, chemical application, and monitoring.
- Before any chemical application, a thorough evaluation of the orchard is essential, identifying the specific issues that need to be addressed.
- These potential issues could include pests, diseases, lacklustre growth, and nutrient deficiencies, among many others.
- Once the problem is identified, an appropriate agrochemical that is approved for use on citrus orchards is selected.
- Agrochemicals should always be applied according to manufacturer instructions, using suitable equipment.
- Application methods vary, ranging from being added into irrigation water (fertigation) to being brushed onto the trunk of the trees to being sprayed over the entire orchard.

- After application, the orchard must be monitored to determine the success of the agrochemical application in terms of solving the problem, or if there were any issues such as side effects.
- Chemical crop control practices related to pest management are timed according to the life cycle of the target pest.
- Chemical crop control practices related to weed management are timed according to the frequency and severity of the weed-related issues and the agrochemical being used.
- Chemical crop control practices related to disease control are timed according to the disease in question and the agrochemical being used.
- Chemical crop control practices related to growth regulation are timed according to the desired outcome, i.e. what type of growth is needed.
- Mechanical crop control refers to the use of machinery and equipment in the orchard environment or on the citrus trees themselves.
- Mechanical crop control can be performed to influence fruit production, manage tree growth, and address pest and disease challenges.
- Mechanical crop control practices include mowing, shredding, tillage, skirting, spraying, and the use of specialised devices for pruning or harvesting.
- Mechanical crop control aims to enhance efficiency, reduce labour requirements, and maintain optimal orchard conditions.
- Mechanical crop control practices are usually performed as large-scale operations, where manual practices may no longer be feasible or efficient.
- Mechanical crop control methods can cover larger areas in shorter time frames, while using significantly less labour, leading to cost savings and more consistent results.
- Mowing and shredding involves using tractors equipped with mowers or shredders to cut the undergrowth and weeds between tree rows regularly and efficiently.
- Mowing and shredding are ideally performed when the weeds in the undergrowth are still relatively young and haven't seeded but can be performed whenever needed.
- Tillage involves using mechanical tillers to break up and turn the soil, especially between rows during orchard establishment.
- Tillage aids in weed control, soil aeration, and the integration of organic matter.
- Tillage is usually performed during the establishment of a new orchard, or during the orchard's dormant phase to minimise disturbance to the trees.
- Tillage may be performed just before the rainy season to aid in water absorption in regions with significant rainfall.
- Skirting involves using specialised equipment to trim the lower branches of citrus trees.
- Skirting ensures easier access for other mechanical practices and reduces pest and disease risks associated with low-hanging branches and fruit.
- Skirting is usually performed throughout the year to prevent disease and pest proliferation.
- Spraying involves using tractor-mounted sprayers for more uniform application of agrochemicals in larger orchards.
- Spraying is timed according to the specific agrochemical being applied.

self-assessment

KT0402: Crop Control Practices

Can I?	Y/N
Can I explain the concept and importance of the leaf-to-fruit ratio?	
Can I describe the difference between flower thinning and fruit thinning?	
Can I explain the benefits of both kinds of thinning?	
Can I perform both flower and fruit thinning?	
Can I describe how the thinning process changes as trees age?	
Can I describe the differences between manual and chemical fruit thinning?	
Can I determine when manual or chemical fruit thinning is more appropriate?	
Can I explain how chemical thinning is performed and which agrochemicals are used?	
Can I describe the differences between physical, chemical, and mechanical crop control practices and give examples of each?	
Can I determine whether physical, chemical or mechanical crop control is most appropriate for a given situation?	
Can I perform physical crop control practices?	
Can I perform chemical crop control practices?	
Can I perform mechanical crop control practices?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0403	The reason, process and timing of flower and fruit thinning are explained	B7, C1, C2, D2, F2
IAC0404	The reason, process and timing of physical, chemical and mechanical crop control practices are explained	C1, C2, D2, E2, F2

KM-03-KT05:
Chemical Manipulation
(12%, 0.96 credits)

Topic Elements

The content of this chapter covers the following topic elements:

- KT0501: Dormancy management
- KT0502: Thinning
- KT0503: Fruit size improvement
- KT0504: Quality improvement

1. KT0501: Dormancy Management

IAC0501: The reason, process and timing of dormancy management are explained

- In a citrus tree's lifecycle, the dormancy stage refers to a period of reduced physiological activity where the tree temporarily halts active growth and conserves energy.
- Dormancy typically occurs during colder months, as the tree naturally rests and prepares for the forthcoming growth season.
- By going dormant during this period, trees can withstand adverse conditions such as extreme cold, while saving energy and resources for the upcoming growth cycle.
- Dormancy is essential for healthy functioning, and this period must be carefully managed.
- A well-managed dormancy will lead to a vigorous bud break and uniform flowering and fruiting, ensuring a successful harvest.
- Dormancy management includes water regulation, pruning, nutrient management, and frost protection.
- Water regulation involves gradually reducing irrigation as the cooler months approach, which aids trees in entering their transition to dormancy.
- Water reduction should be started towards the end of autumn, continuing into the early winter months.
- Pruning after harvest to remove any unhealthy or superfluous branches helps to shape trees and enhance air circulation and sunlight penetration, benefiting trees when they re-enter the active growth phase.
- Post-harvest pruning should be performed in winter, ensuring that the tree is still dormant but close to the upcoming active growth phase.
- Fertilisation plans may need to be adjusted to reduce or eliminate certain nutrient applications to align with the tree's reduced needs.

- Fertilisation plans adjustments can start in late autumn and continue throughout the winter months.
- In areas prone to frost, strategies like protective structures or water application can be used to mitigate potential frost damage during the dormant phase.
- Frost protection should be implemented as needed during the coldest parts of winter, especially on clear, still nights when frost is most likely.

self-assessment

KT0501: Dormancy Management

Can I?	Y/N
Can I describe the dormancy period and its importance?	
Can I describe when dormancy occurs?	
Can I explain the necessary function of dormancy in the lifespan of a citrus tree?	
Can I describe the function and timing of the practices involved in dormancy management?	
Can I perform dormancy management practices?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0501	The reason, process and timing of dormancy management are explained	A5, C2, D1, D2, E1

2. KT0502: Thinning

IAC0502: The reason, process and timing of thinning are explained

Refer to IAC0403: The reason, process and timing of flower and fruit thinning are explained.

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0502	The reason, process and timing of thinning are explained	B7, C1, C2, D2, F2

3. KT0503: Fruit Size Improvement

IAC0503: The reason, process and timing of fruit size improvement are explained

- There are several requirements for fruit to sell well on the highly competitive export market, in terms of both external and internal quality.
- One of the main external qualities of fruit that customers can most easily judge is fruit size, and customers do not want to feel they are over-paying for small fruit.
- Larger, uniformly sized fruits often fetch better prices in the market and are preferred by consumers for their aesthetic appeal and perceived value.
- Enhancing individual fruit size also has the benefit of increasing the overall yield from the orchard in terms of weight and value, even if the number of fruits remains constant.
- Fruit size can also correlate with juice content and overall fruit quality, enhancing the fruit's taste and texture, which creates a relationship between the two in the mind of the customers.
- Consistently producing sizable fruits can bolster an orchard or a farm's brand reputation, ensuring repeat business and better market positioning.
- Final fruit size is not determined solely by the genetics of the fruit but is heavily influenced by orchard practices.
- Production practices that influence fruit size include irrigation management, nutrition management, fruit thinning, canopy management, and pest and disease management.
- Irrigation management involves ensuring consistent and adequate water supply, especially during the fruit development phase.
- Proper irrigation, especially avoiding water stress, can significantly impact fruit size.
- Irrigation must be continuously monitored, with special attention during the fruit development phase, which usually spans late spring to early summer.
- Nutrition management includes regular soil testing and well-planned fertilisation based on the results.
- Proper nutrition management ensure that trees receive all necessary nutrients to grow their fruit to the best size possible.
- While year-round nutrition is crucial, the emphasis should be on the period following flowering until fruit maturity.
- Thinning fruits, especially in densely populated clusters, allows the tree to allocate more resources to the remaining fruits, enhancing their growth potential.
- Thinning is most effective during the early stages of fruit development, typically in late spring.
- Canopy management ensures that the canopy allows even sunlight distribution so that fruits receive the light they need for photosynthesis, which plays a crucial role in their growth.
- Regular canopy checks should be done year-round, but more intensive management is ideal during late winter to early spring, just before the flowering season starts.
- Pest and disease management involves preventing infestations and diseases that can hinder fruit growth.

- Pest and disease management, especially monitoring, is a year-round practice, with preventive measures employed at the beginning of the growing season and reactive measures applied as soon as threats are detected.

self-assessment

KT0503: Fruit Size Improvement

Can I?	Y/N
Can I describe the importance of fruit size?	
Can I explain the process of size development?	
Can I implement practices to positively influence fruit size development?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0503	The reason, process and timing of fruit size improvement are explained	A5, A6, A7, C2, D2

4. KT0504: Quality Improvement

IAC0504: The reason, process and timing of quality improvement are explained

- Fruit quality refers to both external and internal quality, including size, colour, taste, texture, appearance, and nutritional value.
- For export farmers to be successful, farmers must produce the highest quality fruit possible and thus must understand the factors that influence fruit quality, and how to manipulate them.
- High-quality fruit meet consumer expectations, driving repeat purchases and fostering brand loyalty.
- High-quality fruit also often command premium prices, enhancing the farm's profitability and market standing.
- High-quality fruit have better shelf life and reduced susceptibility to post-harvest diseases, resulting in fewer losses during storage and transport.
- High-quality fruit can establish a farm's reputation, leading to better market access, partnerships, and growth opportunities.
- Quality improvement practices include the same practices required to manage fruit size, including nutrition management, irrigation management, pest and disease management, canopy management, and harvest management.
- The methods and timing of these practices regarding fruit size improvement also apply to managing quality.
- Fruit should be harvested at the optimal maturity stage, using techniques that prevent bruising or injury, to achieve maximum quality.
- Proper post-harvest handling, including safe transport and appropriate storage, further preserves fruit quality.

self-assessment

KT0504: Quality Improvement

Can I?	Y/N
Can I describe the difference between external and internal quality?	
Can I explain the importance of quality for export fruit production?	
Can I implement practices to improve fruit quality?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0504	The reason, process and timing of quality improvement are explained	A4, A5, A6, A7, C2

KM-03-KT06:
The Reason, Process and Timing of Thinning are Explained
(12%, 0.96 credits)

Topic Elements

The content of this chapter covers the following topic elements:

- KT0601: Colour improvement

1. KT0601: Colour Improvement

IAC0601: The reason, process and timing of colour improvement are explained

- Colour is another important aspect of quality that significantly influences consumer choices and market reception.
- Citrus fruit come in a wide range of colours, depending on cultivar, type, and production practices.
- Fruit with deep, uniform colour are generally more attractive to consumers, influencing purchasing decisions and commanding better market prices.
- Fruit colour is indicative of ripeness and flavour profile, and customers are aware of this.
- Improving the colour of fruit involves managing sunlight, temperature, nutrition, and growth.
- Ensuring that each fruit receives enough sunlight is vital for proper colour development, and sunlight penetration can be improved through strategic pruning or canopy management to reduce overshadowing.
- These pruning and canopy management practices should ideally be done post-harvest and sunlight exposure should be monitored throughout the growing season.
- Cooler night temperatures, especially during the fruit ripening stage, can enhance colour development in certain citrus varieties.
- Employing techniques to cool down the orchard or planting in locations that are cooler at night can be beneficial for developing colour.
- Managing temperature is a year-round concern, but special attention should be paid during the ripening phase.
- Nutrition management is a year-round commitment, but particular focus should be placed on colour-enhancing nutrients (such as potassium) during the fruit's developmental and maturation stages.
- In some cases, approved growth regulators or plant hormones can be applied to promote uniform colour development across fruits.

- If growth regulators are used, application should be carefully timed based on the specific regulator's guidelines, provided by the manufacturer.

self-assessment

KT0601: Colour Improvement

Can I?	Y/N
Can I describe the importance of fruit colour?	
Can I explain the process of colour development?	
Can I implement practices to positively influence fruit colour development?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0601	The reason, process and timing of colour improvement are explained	A5, A6, A7, C2, D2

KM-03-KT07:
Physical Manipulation
(12%, 0.96 credits)

Topic Elements

The content of this chapter covers the following topic elements:

- KT0701: Shoot positioning (bending down of shoots)
- KT0702: Girdling

1. KT0701: Shoot Positioning (Bending Down of Shoots)

IAC0701: The underlying principle of shoot positioning is discussed

IAC0702: The reason, process and timing of shoot positioning are explained

Refer to IAC0305: The reason, process and timing of shoot positioning are explained.

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0701	The underlying principle of shoot positioning is discussed	B7, C1, C2, D2, D4
IAC0702	The reason, process and timing of shoot positioning are explained	B7, C1, C2, D2, D4

2. KT0702: Girdling

IAC0703: The underlying principle of girdling is discussed

IAC0704: The reason, process and timing of girdling are explained

- Girdling refers to the deliberate removal of a narrow strip of bark around the circumference of a tree trunk or branch.
- Girdling is performed to enhance fruit development, increase flowering, and mitigate alternate bearing.
- Girdling works by disrupting the flow of nutrients in the tree.
- The general consensus is that interrupting the flow of nutrients causes them to accumulate inside the tree, providing various benefits.
- Only healthy trees should be girdled, and that the timing of girdling is critical.
- Improperly performed girdling or girdling performed at the wrong time can be detrimental to the trees.
- Girdling should only be performed in the summer when tree growth is at its highest.
- Trees that are suffering any stress must never be girdled, as this can cause permanent damage to the tree if the bark cannot heal sufficiently.
- The cuts made during girdling must not be too deep, as this can cause long-lasting internal damage to the trees.
- The nutrient accumulation caused by girdling can enhance fruit development and improve overall fruit quality, including size, colour, and taste.
- Girdling can encourage more robust and synchronised flowering in some citrus varieties, thereby potentially increasing fruit set.
- Girdling can mitigate alternate bearing in citrus varieties prone to it, regulating and balancing fruit production over consecutive years.
- The timing of girdling varies depending on the aim.
- If the aim is to improve internal fruit quality or size, girdling is typically performed in the early stages of fruit development, often late spring to early summer.
- Performing girdling in these early development stages allows the fruit to benefit from the accumulated sugars throughout the growth phase.
- If the aim is to influence flowering, girdling should be carried out during the late winter or early spring before the onset of the flowering period.
- If the aim is to improve colour development, girdling can be performed during the later stages of fruit maturity, just before the expected onset of colour changes.
- The procedure of girdling is as follows:
    1. Select a part of the tree trunk or a primary branch for girdling, ensuring it's free from significant blemishes or diseases, and that the tree is healthy.
    2. Sharpen (if needed) and disinfect a specialised girdling knife or appropriate tool and wear gloves.
    3. Make two continuous, parallel, circular cuts, around 1-2cm apart, around the chosen site, through the bark and cambium layer without harming the underlying wood.

4. Remove the bark strip between the cuts carefully.
5. If necessary, apply a protective layer or wrap to prevent potential complications.
6. After girdling, monitor the girdled area regularly for any signs of disease or pest infestations.

self-assessment

KT0702: Girdling

Can I?	Y/N
Can I describe the function and purpose of girdling?	
Can I determine whether girdling is needed?	
Can I perform effective girdling at the proper time?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0703	The underlying principle of girdling is discussed	A5, C1, C2, D2
IAC0704	The reason, process and timing of girdling are explained	A5, C1, C2, D2

KM-03-KT08:
Manipulation Tools / Equipment
(12%, 0.96 credit s)

Topic Elements

The content of this chapter covers the following topic elements:

- KT0801: Handling procedures for tools and material

1. KT0801: Handling Procedures for Tools and Material

IAC0801: The safe use of plant manipulation tools and equipment is described

- The manipulation process is an important part of citrus production, and the success of manipulation practices is often based on the tools used.
- Selecting and using low quality, unsuitable, or badly maintained tools and equipment can render manipulation practices ineffective and even harmful.
- Tools and equipment must also be used in the proper manner to ensure that manipulation practices are effective.
- Selecting the correct tools and equipment is vital, as proper selection can save time, limit damage to the tree, and limit injury to the worker.
- All tools should be used according to manufacturer instructions.
- Any blades should be regularly checked for sharpness.
- Any springs should be regularly checked for tension.
- All tools should be regularly sterilised, especially when moving between orchard blocks.
- Health and safety principles and practices must always be in place when performing any production practice.
- Aside from these general rules, the table below lists various manipulation practices, the associated tools and equipment, and descriptions of the correct use of those specific tools:

Manipulation Practice	Tools / Equipment	Correct Use
Pruning	➢ Pruning shears ➢ Lopping shears ➢ Bow saw ➢ Pruning saw ➢ Wound sealant ➢ Ladder ➢ Mulching equipment ➢ Sterilising agent	➢ Pruning shears are used to cut branches up to 30mm thick. ➢ Lopping shears are used to cut branches up to 45mm thick. ➢ Bow saws are used to cut branches thicker than 45mm. ➢ Pruning saws are used to cut branches thicker than 45mm, with a cleaner cut. ➢ Wound sealant is used to seal pruning wounds. ➢ Ladders are used to reach higher parts of tree.

Manipulation Practice	Tools / Equipment	Correct Use
		➢ Mulching equipment are used to chop up foliage left in rows after pruning. ➢ Sterilising agents are used to sterilise tools and equipment.
Skirting	➢ Skirting stick ➢ Pruning shears ➢ Lopping shears ➢ Bow saw ➢ Pruning saw ➢ Wound sealant ➢ Mulching equipment ➢ Sterilising agent	➢ Skirting sticks are used to measure the height at which tree should be skirted. ➢ Pruning shears are used to cut branches up to 30mm thick. ➢ Lopping shears are used to cut branches up to 45mm thick. ➢ Bow saws are used to cut branches thicker than 45mm. ➢ Pruning saws are used to cut branches thicker than 45mm, with a cleaner cut. ➢ Wound sealant is used to seal pruning wounds. ➢ Mulching equipment are used to chop up foliage left in rows after pruning. ➢ Sterilising agents are used to sterilise tools and equipment.
Girdling	➢ Carpet or utility knife ➢ Girdling saw or knife ➢ Girdling pliers ➢ Sterilising agent	➢ Carpet or utility knives are used to make thin cuts through tree bark. ➢ Girdling saws or knives are used to make thin cuts through tree bark. ➢ Girdling pliers are used to make thin cuts through tree bark. ➢ Sterilising agents are used to sterilise tools and equipment.
Fruit Thinning	➢ Fruit count frame ➢ Knapsack ➢ Sprayer ➢ Fruit measuring callipers	➢ Fruit count frames are used to count the number of fruits on a tree. ➢ Fruit count callipers are used to measure fruit size. ➢ Knapsacks and sprayers are used to apply agrochemicals.
Fruit Set Improvement	➢ Fruit count frame ➢ Knapsack ➢ Sprayer ➢ Fruit measuring callipers	➢ Fruit count frames are used to count the number of fruits on a tree. ➢ Fruit count callipers are used to measure fruit size. ➢ Knapsacks and sprayers are used to apply agrochemicals.
Fruit Size Enlargement	➢ Fruit count frame ➢ Knapsack ➢ Sprayer ➢ Fruit measuring callipers	➢ Fruit count frames are used to count the number of fruits on a tree. ➢ Fruit count callipers are used to measure fruit size. ➢ Knapsacks and sprayers are used to apply agrochemicals.
Delaying Harvest	➢ Knapsack ➢ Sprayer ➢ Fruit measuring callipers	➢ Fruit count callipers are used to measure fruit size. ➢ Knapsacks and sprayers are used to apply agrochemicals.
Creasing Control	➢ Knapsack ➢ Sprayer ➢ Fruit measuring callipers	➢ Fruit count callipers are used to measure fruit size. ➢ Knapsacks and sprayers are used to apply agrochemicals.

Table 1: Plant Manipulation Tools and Equipment

- Once the correct tool has been selected, the tool must be used correctly and safely.
- Many manipulation tools have blades which can cause serious injury to a worker that is not well trained.
- In the table below is a list of the tools and equipment that are used in plant manipulation, together with notes on their correct use and possible issues.
- All tools should be used safely and with the proper protective gear and should be used according to manufacturer instruction.

Equipment	Correct Use	Possible Issues
Pruning Shears	➢ Select appropriate left- or right-handed shears. ➢ Ensure blades are sharp and not rusted. ➢ Make one clean cut. ➢ Sterilise regularly.	➢ Blades are not sharp. ➢ Blades or bolts are loose. ➢ Branch is too thick to cut. ➢ Tool is not sterile.
Lopping Shears	➢ Select appropriate left- or right-handed shears. ➢ Ensure blades are sharp and not rusted. ➢ Make one clean cut. ➢ Sterilise regularly.	➢ Blades are not sharp. ➢ Blades or bolts are loose. ➢ Branch is too thick to cut. ➢ Tool is not sterile.
Bow Saw	➢ Ensure blade is sharp, taught and not rusted. ➢ Sterilise regularly.	➢ Blade is not taught. ➢ Blade is not sharp. ➢ Blade is rusted. ➢ Blade is twisted. ➢ Tool is not sterile.
Pruning Saw	➢ Ensure blade is sharp and not rusted. ➢ Sterilise regularly. ➢ Use with pull action (one way).	➢ Blade is not taught. ➢ Blade is not sharp. ➢ Blade is rusted. ➢ Blade is twisted. ➢ Saw gets stuck due to pushing. ➢ Tool is not sterile.
Wound Sealant	➢ Ensure suitability for citrus. ➢ Apply with brush.	➢ Sealant is toxic to citrus.
Carpet / Utility Knife	➢ Ensure blade is sharp and not rusted. ➢ Make clean cuts. ➢ Sterilise regularly.	➢ Cut is not clean. ➢ Blade is too thin or too thick. ➢ Blade is rusted. ➢ Blade is not sharp. ➢ Tool is not sterile.
Girdling Saw / Knife	➢ Cut cleanly right around the trunk. ➢ Cut at correct height. ➢ Cut only the bark. ➢ Do not loosen or remove the bark. ➢ Ensure blade is sharp and not rusted. ➢ Sterilise regularly.	➢ Cut is not clean. ➢ Cut is not right around the trunk. ➢ Cut is too deep. ➢ Blade is too thin or too thick. ➢ Blade is not sharp. ➢ Blade is rusted. ➢ Surrounding bark is torn or loosened. ➢ Tool is not sterile.
Girdling Pliers	➢ Adjust pliers to correct size. ➢ Cut cleanly right around the trunk. ➢ Cut at correct height. ➢ Cut only the bark.	➢ Cut is not clean. ➢ Cut is not right around the trunk. ➢ Cut is too deep. ➢ Blade is too thin or too thick.

Equipment	Correct Use	Possible Issues
	➢ Do not loosen or remove the bark. ➢ Ensure blade is sharp and not rusted. ➢ Sterilise regularly.	➢ Blade is not sharp. ➢ Blade is rusted. ➢ Surrounding bark is torn or loosened. ➢ Tool is not sterile.
Skirting Stick	➢ Ensure stick is the correct length. ➢ Measure on even ground. ➢ Hold sticks upright (perpendicular to the ground) to measure cutting height.	➢ Incorrect length. ➢ Ground is not even. ➢ Stick not held upright, giving inaccurate measurements.
Ladders	➢ Ensure ladder is securely placed on stable ground. ➢ Ensure ladder is high enough. ➢ Ensure ladder rungs and side-posts are strong and not broken.	➢ Rungs or posts are broken. ➢ Ladder is too short. ➢ Ladder is not stably placed.
Mulching Equipment	➢ Use appropriately sized mulcher for tractor size. ➢ Ensure that all parts of the mulcher are in good condition. ➢ Ensure that plant matter is not too large or thick to be mulched.	➢ Tractor or mulcher are too small. ➢ Mulcher is broken and unsafe to use. ➢ Plant material is too large or thick to be mulched and jams up the mulcher.
Fruit Count Frame	➢ Select a representative tree to count. ➢ Insert the count properly into tree in a representative area. ➢ Count slowly and carefully and double check the count. ➢ Mark and record the result.	➢ Frame is not placed deeply enough in tree. ➢ Non-representative tree is selected. ➢ Count is incorrect. ➢ Count is not recorded.
Fruit Measuring Callipers	➢ Read instructions on how to use specific callipers. ➢ Measure all fruit in a consistent method. ➢ Measure the same part of each fruit.	➢ Callipers are not used correctly and give inaccurate measurements. ➢ Different parts of fruit are measured.
Gloves	➢ Use suitable gloves for the task in question. ➢ Ensure that gloves are not torn or damaged.	➢ Wrong gloves are used for production practices. ➢ Gloves are torn or otherwise damaged.
Safety Goggles	➢ Use goggles of correct size. ➢ Use goggles suitable for the task in questions. ➢ Ensure goggles are not damaged.	➢ Lenses are broken. ➢ Goggles do not fit properly. ➢ Goggles are not suitable for the purpose.

Table 2: Plant Manipulation Tools and Equipment

IAC0802: The sterilisation of tools and equipment during and after plant manipulation tasks is discussed and motivated

- Sterilisation refers to the process of eliminating harmful micro-organisms and pathogens (like fungi, bacteria, and viruses) from the tools and equipment used for plant manipulation.
- Sterilisation prevents the transmission of diseases and pests between trees, ensuring healthy growth and minimising risks of infection.

- Many plant diseases, especially those caused by fungi and bacteria, can spread very easily through tools, especially cutting tools.
- Diseases can be hugely damaging to farms, as diseased trees can have stunted growth, reduced yield, and lower-quality fruit.
- All of these negatively impact the farm's production and thus its revenue, and some of the worst diseases can kill entire trees or orchards.
- The cost of managing and treating diseased trees can be considerable, as it includes the cost of treatment itself, as well as potential losses from reduced yield.
- The added effort and expense of proper sterilisation are minimal compared to the potential losses caused by improper sterilisation and the resultant spread of diseases.
- Sterilisation practices should become "habitual" for workers, where they perform it naturally without repeated encouragement and reminders.
- An added benefit of consistent sterilisation is that any sudden outbreak of disease can most likely be attributed to factors that are not related to sterilisation, allowing for more accurate diagnosis of the problem.
- The most common sterilisation agent is bleach, which is usually diluted into a solution of 1% of the active ingredient, depending on manufacturer recommendations.
- The water used for the sterilisation solution must have a neutral (or nearly neutral) pH.
- If the pH of the solution water is too high or too low, it must be adjusted until the desired pH of 7 is obtained.
- Once the bleach solution is mixed, it must be used within 5 hours, and stored out of direct sunlight, as sunlight adversely affects the effectiveness of the bleach.
- To sterilise equipment, the part of the tool being sterilised (such as the blades of a clipper) must be wetted with the solution, either by spraying or dipping, and allowed to air-dry before use.
- This air-drying of the surfaces ensures that the solution has a sufficient contact time, and thus enough time to eliminate all the microorganisms that may be present on the equipment.
- All cutting tools must be sterilised at the start of the day, before being used, and directly after each use (i.e., between every tree).
- Other tools must also be sterilised regularly, normally after 100 trees, and when moving between orchards.

IAC0803: The maintenance and storage of tools and equipment is outlined

- Tools and equipment can be expensive pieces of equipment, and storing and maintaining them according to proper procedure is vital for ensuring they work effectively for many years.
- By maintaining equipment effectively, equipment lasts longer and is ready for use when necessary.
- The first step in planning and managing maintenance is the design and implementation of a maintenance schedule.
- The maintenance schedule ensures that the necessary maintenance tasks and duties are performed at the correct time and in the correct manner.

- The implementation of this maintenance schedule must be monitored and managed carefully by a qualified worker.
- The schedule should be accompanied by the design of a recordkeeping system that allows for the effective capture and analysis of maintenance data.
- The table below lists manipulation tools and equipment, along with the corresponding maintenance tasks that they require, and the appropriate schedule for those tasks:

Tools / Equipment	Maintenance Tasks	Schedule
Pruning shears	➢ Sharpen blades. ➢ Sterilise. ➢ Lightly oil hinges. ➢ Replace rusted or broken parts.	➢ Blades should be sharpened whenever necessary, but at least twice a year. ➢ Equipment must be sterilised after use and when moving between orchards. ➢ Hinges must be oiled before use and before storage. ➢ Rusted or broken parts must be replaced as soon as they are noticed.
Lopping shears	➢ Sharpen blades. ➢ Sterilise. ➢ Lightly oil hinges. ➢ Replace rusted or broken parts.	➢ Blades should be sharpened whenever necessary, but at least twice a year. ➢ Equipment must be sterilised after use and when moving between orchards. ➢ Hinges must be oiled before use and before storage. ➢ Rusted or broken parts must be replaced as soon as they are noticed.
Bow saw	➢ Sharpen blade. ➢ Sterilise. ➢ Replace rusted, bent or broken parts.	➢ Blade should be sharpened whenever necessary, but at least twice a year. ➢ Equipment must be sterilised after use and when moving between orchards. ➢ Rusted, bent or broken parts must be replaced as soon as they are noticed.
Pruning saw	➢ Sharpen blade or replace if necessary. ➢ Check and adjust blade tension if necessary. ➢ Sterilise. ➢ Replace rusted or broken parts.	➢ Blade should be sharpened whenever necessary, but at least twice a year. ➢ Blade tension must be checked before use and relaxed after use. ➢ Equipment must be sterilised after use and when moving between orchards. ➢ Rusted or broken parts must be replaced as soon as they are noticed.
Ladder	➢ Tighten hinges. ➢ Check steps for stability. ➢ Replace rusted or broken parts.	➢ Ladder must be checked before and after use. ➢ Rusted or broken parts must be replaced as soon as they are noticed.
Mulching equipment	➢ Service tractors. ➢ Service mulching equipment. ➢ Strip and clean mulching equipment. ➢ Rusted or broken parts must be replaced as soon as they are noticed.	➢ Tractors must be serviced at least once a year by a trained mechanic. ➢ Mulching equipment must be stripped and cleaned after use. ➢ Mulching equipment must be serviced according to the manufacturer's recommendations. ➢ Rusted or broken parts must be replaced as soon as they are noticed.

Tools / Equipment	Maintenance Tasks	Schedule
Carpet or utility knife	➢ Replace blade when necessary. ➢ Sterilise. ➢ Rusted or broken parts must be replaced as soon as they are noticed.	➢ Blade should be sharpened whenever necessary, but at least twice a year. ➢ Equipment must be sterilised after use and when moving between orchards. ➢ Rusted or broken parts must be replaced as soon as they are noticed.
Girdling saw or knife	➢ Replace blade when necessary. ➢ Sterilise. ➢ Rusted or broken parts must be replaced as soon as they are noticed.	➢ Blade should be sharpened whenever necessary, but at least twice a year. ➢ Equipment must be sterilised after use and when moving between orchards. ➢ Rusted or broken parts must be replaced as soon as they are noticed.
Girdling pliers	➢ Sharpen blades. ➢ Sterilise. ➢ Lightly oil hinges. ➢ Replace rusted or broken parts.	➢ Blades should be sharpened whenever necessary, but at least twice a year. ➢ Equipment must be sterilised after use and when moving between orchards. ➢ Hinges must be oiled before use and before storage. ➢ Rusted or broken parts must be replaced as soon as they are noticed.
Fruit count frame	➢ Sterilise. ➢ Replace rusted or broken parts.	➢ Equipment must be sterilised after use and when moving between orchards. ➢ Rusted or broken parts must be replaced as soon as they are noticed.
Fruit measuring callipers	➢ Calibrate regularly. ➢ Sterilise. ➢ Replace rusted or broken parts.	➢ Calibrate according to the manufacturer's recommendations. ➢ Equipment must be sterilised after use and when moving between orchards. ➢ Rusted or broken parts must be replaced as soon as they are noticed.

Table 3: Equipment Maintenance

- Proper storage is just as important as proper maintenance, as maintaining tools to a high standard then storing them in an improper way will render the maintenance pointless.
- Proper storage increases the lifespan of tools and equipment, prevents the spread of diseases, saves maintenance and tool costs, and keeps the tools in a ready-to-use condition.
- Tools and equipment must always be in good, clean condition before they are stored, as properly storing an unsterilised or broken piece of equipment is pointless.
- All tools and equipment must be cleaned before storage, and any soil or plant material (such as sap or bits of leaves) must be removed.
- After cleaning, tools and equipment must be sterilised and then rinsed with water and dried thoroughly.
- Drying is an important step and should not be skipped, as storing tools when wet can lead to rust, which can cause tools to become ineffective and ultimately useless over time.

- Certain tools may have special storage requirements, such as cutting tools having special covers to protect their edges, and these requirements should always be followed accordingly.
- The storeroom should be clean, cool, secure, dry, and well-organised, and designed using organisation systems such as pegboards or shelves to organise tools and equipment.
- Tools and equipment should never be stored in a way that they can damage each other by knocking against or falling onto each other.
- Even while in storage, tools and equipment must still be regularly maintained.
- Tools and equipment in storage must be regularly checked for signs of rust, wear, or damage.
- It may be necessary to grease or sharpen the tools if they have been in storage for an extended period.
- Large, dangerous tools or equipment (such as chainsaws) must be stored in a secure place, where they cannot be used or tampered with by unauthorised individuals.
- Storerooms should have secure locks on their doors, and keys should only be available to specific personnel, such as storeroom managers and foremen.
- Recordkeeping is an important part of managing tools and equipment.
- Records must be kept of the tools and equipment issued, what they were used for, the worker who used them, and in which orchard and block they were used.
- These records help if a tool or piece of equipment goes missing, as it makes it easy to identify where the tool was last used and who last used it, and thus where it is most likely to be.
- A system must be in place from which it can be identified what tools and equipment are in the storeroom, and how much of them there are available.
- An "incident" refers to an accident or a near accident at the workplace where workers were or could have been injured or killed, safety was compromised, or property was damaged.
- All incidents, especially those caused by a faulty tool or tool misuse, should be recorded.

self-assessment

KT0801: Handling Procedures for Tools and Material

Can I?	Y/N
Can I explain the importance of using the appropriate tools for manipulation?	
Can I select the appropriate tools for manipulation practices?	
Can I practice health and safety when using tools and equipment?	
Can I explain the importance of sterilisation?	
Can I describe how diseases spread on unsterilised tools?	
Can I properly sterilise tools and equipment?	
Can I describe proper maintenance practices for tools and equipment?	
Can I draw up and interpret a maintenance schedule?	
Can I describe proper storage practices for tools and equipment?	
Can I properly clean, sterilise, dry, and store tools and equipment?	
Can I ensure the storeroom is secure and properly organised?	
Can I keep proper records of storage and tool use?	
Can I write an incident report?	
Can I select and safely use the appropriate equipment for plant manipulation?	
Can I properly maintain and store plant manipulation equipment?	

work scenario reference

To learn about how the above information is applied in practice, please look at the following workplace scenarios:

IAC Code	IAC Title	Relevant Work Scenario(s)
IAC0801	The safe use of plant manipulation tools and equipment is described	A4, C1, C2, J2, K1
IAC0802	The sterilisation of tools and equipment during and after plant manipulation tasks is discussed and motivated	C1, C2, I3, J2
IAC0803	The maintenance and storage of tools and equipment is outlined	I1, I2, I3, I4, I8