Citrus Orchard Foreman Occupational Learning

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Study Guide

KM-01:
Plant Structure and Physiology

Qualification:	110667 – Occupational Certificate: Orchard and Vineyard Foreman		
Module No.:	611202001-KM-01		
Module Title:	Plant structure and physiology		
NQF Level:	4	**Credits:**	5

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Content originator:
Citrus Academy

Occupational alignment:
Ukudla Namanzi (Pty) Ltd

Alignment Reference Table

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-01-KT01	**Plant structure and physiology (100%, 5 credits)**
KT0101	Seasonal cycle
KT0102	Plant growth requirements
KT0103	Young plant development stages
IAC0101	The vegetative and reproductive seasonal cycle of the crop is described
IAC0102	The reason for specific production practices during specific stages in the seasonal cycle is explained
IAC0103	The impact of conditions and practices during the current season on the following season is discussed
IAC0104	The growth requirements of plants including air, nutrients and water are listed
IAC0105	The principles of good plant nutrition practices (Good Agricultural Practices) are outlined and discussed in terms of their impact on production
IAC0106	Plant nutritional requirements during the various stages of fruit production are delineated
IAC0107	The implications of nutritional conditions on market readiness is described
IAC0108	Young plant growth and development stages are described in terms of the practices and procedures that are implemented at those stages

KM-01-KT01:
Plant Structure and Physiology
(100%, 5 credits)

topic elements

The content of this chapter covers the following topic elements:

1. KT0101: Seasonal cycle
2. KT0102: Plant growth requirements
3. KT0103: Young plant development stages

1. KT0101: Seasonal Cycle

IAC0101: The vegetative and reproductive seasonal cycle of the crop is described

- The average economic lifespan of a commercial citrus orchard varies between 18 and 30 years but can be as high as 30 to 60 years in hot, dry areas.
- For citrus production to be profitable, the orchard must produce high yields of quality fruit, every year, and do this consistently over a long period of time.
- Phenology refers to regularly recurring biological phenomena and the environmental and climatic factors that influence them.
- In citrus, phenology specifically refers to the annual cycle of the citrus tree.

Stage	Description	Time Period
Flower Induction and Initiation	Flower initiation is the induction and differentiation of vegetative buds into flower buds at a cellular level and cannot be seen with the naked eye.	May to July
Flowering	Flowering or "bloom" is when blossoms appear on the tree.	August to Mid-September
Cell Division and Fruit Set	Cell division is the period when the cells making up the fruit increase in number. Fruit set is the period from flowering or "bloom" until the end of fruitlet drops, after which the final fruit load is determined.	Mid-September to November
Cell Enlargement and Fruit Growth	Cell enlargement is the period during which cells making up the fruit increase in size. Fruit growth is the period during which the fruit grows and develops.	December to Mid-February

Stage	Description	Time Period
Fruit Maturation and further Fruit Growth	During this period fruit enlarges further and matures internally, meaning that the flavour, sugars, and acids reach their optimum levels.	Mid-February to September
Harvest	N/A	July to September

Table 1: Descriptions of the Stages of the Annual Cycle of the Valencia Orange Tree

- The term "citrus season" refers to the period from when flower initiation begins to the harvest.
- The vegetative cycle focuses on tree growth, while the reproductive cycle centres on fruit production.
- The vegetative cycle is when the tree dedicates its energy to tasks such as producing new leaves, expanding its root system, and developing sturdy branches.
- The reproductive cycle is when the tree produces blossoms that eventually develop into fruit.

IAC0102: The reason for specific production practices during specific stages in the seasonal cycle is explained

- Pruning allows for the removal of dead or diseased branches, enhancing the overall health of the tree.
- In South Africa, citrus trees should typically be pruned during the winter months during the dormant period of citrus trees.
- Winter pruning helps maintain the desired size and shape of trees, promoting an open canopy structure.
- Winter pruning encourages the development of new shoots and branches when spring arrives.
- Citrus trees are fertilised throughout the year, usually with one- or two-month long breaks between applications, with the application frequency increasing or decreasing depending on the season.
- The most effective and vital fertilisation is generally performed during the spring months, particularly from late winter through early spring.
- Pests and diseases must be managed throughout the year.
- Irrigation is performed throughout the year, with the level and frequency of irrigation adjusted throughout the year to account for changes in humidity and temperature throughout the seasons.
- Citrus trees must not be excessively watered, as waterlogged soil can lead to root rot and other health problems for the tree and farmer.
- Soil moisture levels must be closely monitored and irrigation practices adjusted accordingly.
- In South Africa, citrus trees are typically harvested from July to September, depending on the citrus variety and region.
- This period aligns with the natural ripening of citrus fruit, ensuring that the fruit is at its peak of flavour, colour, size, and quality.

- Harvesting during the cooler months also helps mitigate the risk of heat damage to the fruit, as excessive heat can lead to sunburn and reduced fruit quality.
- Harvesting during the late seasonal cycle allows for an extended storage period and facilitates efficient transportation and marketing of the fruit.

IAC0103: The impact of conditions and practices during the current season on the following season is discussed

- Environmental conditions that trees experience during one season can have a significant impact on their health and productivity in future citrus seasons.
- Environmental factors like temperature, rainfall, humidity, and sunlight levels that trees experience can influence the tree's overall condition and its ability to bear fruit in following years.
- Production practices performed during a season can influence the performance and health of the trees in the following seasons.
- Pruning, fertilisation, pest and disease management, and irrigation are among the key practices that significantly impact the tree's current and future health and fruiting potential.
- Ensuring that all production practices are properly executed will ensure trees remain healthy and productive in the long term.

self-assessment

KT0101: Seasonal Cycle

Can I?	Y/N
Can I describe the lifespan of a citrus tree?	
Can I describe the concept of phenology and the stages of the phenology of a citrus tree?	
Can I explain the citrus season?	
Can I differentiate between the vegetative and reproductive cycle of a citrus tree?	
Can I explain why specific production practices are performed during specific stages in the seasonal cycle?	
Can I describe the timing, function, and specific practices of pruning?	
Can I describe the timing, function, and specific practices of fertilisation?	
Can I describe the timing, function, and specific practices of irrigation?	
Can I describe the timing, function, and specific practices of IPM?	
Can I describe the timing, function, and specific practices of harvesting?	

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 vegetative and reproductive seasonal cycle of the crop is described	A1, A2, E1, F1, G1
IAC0102	The reason for specific production practices during specific stages in the seasonal cycle is explained	A2, A4, D2, F1, G1
IAC0103	The impact of conditions and practices during the current season on the following season is discussed	A1, A2, C1, F1, G1

2. KT0102: Plant Growth Requirements

IAC0104: The growth requirements of plants including air, nutrients and water are listed

- Citrus trees, like all plants, require sunlight, water, air, and nutrients to survive and grow.
- Citrus trees typically require a minimum of 6 to 8 hours of direct sunlight daily.
- Citrus trees need a constant, well-distributed supply of water throughout the year, particularly during dry periods.
- Citrus trees require adequate air circulation within their canopy to prevent the proliferation of certain diseases and to ensure their overall well-being.
- Citrus trees require a balanced supply of multiple essential nutrients, including nitrogen, phosphorus, potassium, iron, zinc, and manganese, among others.
- These nutrients are essential for various processes such as photosynthesis, cell division, and the formation of essential plant structures like leaves, stems, and fruit.
- Citrus trees receive these nutrients by absorbing them from the soil through their root system.
- Photosynthesis is the biological process by which citrus trees convert light energy (usually sunlight) into chemical energy, stored in the form of glucose (sugar) and oxygen.
- Photosynthesis is vital for the tree's survival and forms the foundation for food production in the tree.
- Sunlight is absorbed by chlorophyll pigments in the leaves.
- Citrus trees absorb water through their root systems, transporting it to the leaves where it participates in the photosynthetic process.
- Water molecules are split in a process called photolysis, releasing oxygen as a by-product, and providing electrons essential for the formation of glucose.
- Air provides carbon dioxide (CO2), which is another crucial ingredient in photosynthesis.
- Citrus trees draw in carbon dioxide from the surrounding air through tiny openings called stomata on their leaves.
- This absorbed carbon dioxide combines with the hydrogen ions generated from water during photolysis to create glucose molecules.
- Nutrients are not directly involved in the energy conversion steps of photosynthesis but are vital for the overall health and efficiency of citrus trees.
- Nutrients such as nitrogen (N), phosphorus (P), and potassium (K) support the formation of chlorophyll and other molecules involved in photosynthesis.

IAC0105: The principles of good plant nutrition practices (Good Agricultural Practices) are outlined and discussed in terms of their impact on production

- Citrus trees require a balanced mix of essential macronutrients and micronutrients to grow, develop, and produce fruit.
- Each nutrient has a specific function within the tree, and an imbalance can lead to a range of issues, including reduced fruit yield and quality, increased susceptibility to diseases and pests, and less vigorous growth.
- Macronutrients are the essential elements required by citrus trees in large quantities.

- Micronutrients are the essential elements required by citrus trees in trace (small) quantities.
- Macronutrients include nitrogen (N), phosphorus (P), potassium (K), calcium (Ca), magnesium (Mg), and sulphur (S).
- Micronutrients include iron (Fe), manganese (Mn), zinc (Zn), copper (Cu), boron (B), and molybdenum (Mo).
- While micronutrients are needed in smaller quantities, they are as important as macronutrients in maintaining tree health and productivity.

IAC0106: Plant nutritional requirements during the various stages of fruit production are delineated

- Soil sampling involves the systematic, regular collection and examination of soil samples to assess key soil properties such as pH levels, nutrient content, moisture, and texture.
- These analyses provide insight into the specific nutritional needs of the citrus trees and the overall condition of the orchard's soil.
- This information gives growers the ability to perform effective nutrient management practices.
- Fertilisation involves the deliberate and precise application of nutrients (in the form of fertilisers) to provide citrus trees with the essential nutrients they require.
- The choice of fertiliser used is based on the specific nutrient requirements of citrus trees at various growth stages.
- Nitrogen (N), phosphorus (P), potassium (K), and various micronutrients are common components of citrus fertilisers.
- The timing and method of fertiliser application varies depending on the time of year, the age of the tree, and the specific nutrients needed.
- Nutrient uptake refers to the process by which citrus trees absorb essential nutrients from the soil through their root systems.
- The nutrient requirements of citrus trees fluctuate throughout the year, with nutrient uptake being highest during periods of active growth.

IAC0107: The implications of nutritional conditions on market readiness is described

- The nutritional conditions of citrus trees have profound effects on both the internal and external quality of their fruit, and thus the suitability of the fruit for the export market.
- Adequate nutrient supply, particularly potassium (K), is crucial for the development of fruit size, colour, and overall appearance.
- Nutrient management influences internal attributes such as juice content, sugar content, and overall flavour.
- Nutrients like calcium (Ca) help to prevent disorders and maintain fruit texture.
- Adequate nutrient supply also tends to produce fruit with thicker rinds, which protect against physical damage and moisture loss during transportation and storage, extending shelf life.
- Nutrition also affects yields, and adequate nutrient supply is necessary for consistent fruit yields year after year.

- Yield reliability is essential for meeting export market demands and maintaining good relationships with international buyers or export agents.
- The South African citrus industry faces global competition, and maintaining a reputation for high-quality fruit is crucial.
- Nutrition management directly impacts fruit quality, and thus the reputation of South African citrus.

self-assessment

KT0102: Plant Growth Requirements

Can I?	Y/N
Can I describe the growth requirements of a citrus tree?	
Can I describe the function and absorption of nutrients in citrus trees?	
Can I describe the function and absorption of water in citrus trees?	
Can I describe the function and absorption of air in citrus trees?	
Can I describe the function and absorption of sunlight in citrus trees?	
Can I explain the process and purpose of photosynthesis?	
Can I define and list the macronutrients required by citrus trees?	
Can I define and list the micronutrients required by citrus trees?	
Can I describe the process of nutrient uptake?	
Can I explain the purpose and procedures of soil sampling?	
Can I explain the effects of nutritional conditions on external fruit quality?	
Can I explain the effects of nutritional conditions on internal fruit quality?	
Can I explain the relationship between fruit quality and market readiness?	

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)
IAC0104	The growth requirements of plants including air, nutrients and water are listed	B3, B7, D1, D2, E2
IAC0105	The principles of good plant nutrition practices (Good Agricultural Practices) are outlined and discussed in terms of their impact on production	A6, D1, D4, E2
IAC0106	Plant nutritional requirements during the various stages of fruit production are delineated	A5, B7, D2, D3, E2
IAC0107	The implications of nutritional conditions on market readiness is described	A6, A7, D2

3. KT0103: Young Plant Development Stages

IAC0108: Young plant growth and development stages are described in terms of the practices and procedures that are implemented at those stages

- Young citrus trees go through several critical stages, each requiring specific production practices and procedures.
- These stages are planting and establishment, early growth, transition to canopy growth, and blossom and fruit set.
- During planting, the site must be carefully selected to have suitable soil conditions, and this soil must be properly prepared.
- Soil preparation includes clearing weeds and debris, testing the soil to assess nutrient levels and pH, and incorporating organic matter to improve soil structure.
- Only healthy, disease-free stock from an accredited nursery should be planted, and should be inspected before planting.
- Young trees must be handled carefully to avoid root damage and desiccation.
- Young trees in storage or during transport before planting should always be kept moist and protected from sun and wind exposure to minimize stress.
- Trees must be planted at the proper depth, properly spaced from each other.
- The graft union (the point where the rootstock and scion are joined) must be positioned above the soil line to prevent rootstock sprouting.
- Irrigation during planting and establishment must be carefully managed to ensure that young trees receive consistent, sufficient moisture, without waterlogging the soil.
- Many young citrus trees require staking or support systems to prevent leaning or breakage in strong winds, and to train them to grow into the required shape.
- Stakes must be properly installed and tied to the young trees in such a way that they provide stability without causing damage to the trees' trunks.
- Young citrus trees are very susceptible to pests and diseases and must be protected using IPM practices.
- These practices include regular monitoring, pest and disease identification, and limited use of agrochemicals when necessary.
- Rootstock selection affects disease susceptibility, as some rootstocks are more resistant to certain diseases than others.
- Young trees have modest nutrient requirements compared to more mature trees, but proper nutrition is still essential for growth.
- During early growth stages, trees must be carefully pruned and trained to shape the tree's structure and promote an open canopy.
- Pruning also removes damaged or dead branches, improving overall tree health and vigour.
- During early growth, trees require fertilisation to ensure that they receive the essential nutrients they require.
- During early growth, irrigation must be managed to ensure that the young citrus trees receive consistent and sufficient moisture.

- Effective weed control is essential in the early years of citrus tree growth, as weeds compete with young trees for water and nutrients and can harbour pests and diseases.
- Depending on the citrus variety and growth pattern, some young trees may require support systems like stakes or trellises even after the establishment period, to ensure they grow upright and develop strong trunks.
- As trees mature, they shift their focus from root and trunk development to canopy growth.
- During this transition to canopy growth, proper pruning and training are vital to create a well-balanced canopy structure.
- Pruning helps to remove competing branches, twisted branches, suckers, deadwood, and excessive growth, allowing for better sunlight penetration and air circulation.
- A well-shaped canopy enhances photosynthesis, supports flower and fruit production, and eases orchard management tasks such as harvesting and pest control.
- Nutrient management, as in the first two stages, remains critical during the transition to canopy growth.
- This increased canopy growth requires consistent, adequate irrigation to support the trees' increased water needs.
- IPM practices should continue during the transition to canopy growth phase, as the larger trees provide more habitat for pests and diseases.
- Thinning may be necessary during the transition to canopy growth to reduce excess fruit load during this stage.
- Thinning ensures that the remaining fruit receive adequate sunlight and space to develop properly.
- Other canopy management techniques, such as hedging and topping, may also be employed to control canopy size and shape for efficient orchard management.
- Regular soil testing and nutrient analysis should continue throughout the transition to canopy growth.
- The final stage, blossom and fruit set, marks the beginning of fruit production.
- Adequate and balanced fertilisation is especially important during the blossom and fruit set stage.
- Trees in this stage have very specific nutrient requirements at this phase, with an increased need for calcium (Ca) and magnesium (Mg) to support flower and fruit development.
- Although citrus trees are primarily self-pollinating, they can benefit from pollinators like bees to enhance fruit set.
- If there is a lack of pollinators in the orchard, their populations can be increased by providing a conducive environment for them.
- Water is essential to support fruit development during this stage, and as such trees require consistent moisture through irrigation to prevent water stress.
- Citrus trees are susceptible to various pests and diseases at this stage, as many of the most concerning pests (such as FCM) reproduce by laying eggs in their fruit.
- IPM practices should be continuously implemented to identify potential threats and appropriate control measures taken as needed.

- Thinning practices may again be necessary during fruit set to remove excess fruit and achieve an optimal fruit load.
- Overcrowded fruit clusters can lead to smaller fruit size, reduced fruit quality, and increased susceptibility to pests and diseases.
- As in the other stages, regular soil and leaf tissue analysis will help assess the nutrient status of the trees and make informed decisions about nutrient management.

self-assessment

KT0103: Young Plant Development Stages

Can I?	Y/N
Can I list and describe the growth stages of young citrus tree?	
Can I describe the specific practices required for trees in transport and storage before planting?	
Can I describe the specific practices required to prepare a planting area?	
Can I explain proper planting procedure?	
Can I explain the changes in irrigation practices throughout various growth stages?	
Can I explain the changes in nutrition management and fertilisation practices throughout various growth stages?	
Can I explain the changes in IPM practices throughout various growth stages?	
Can I explain the changes in pruning practices throughout various growth stages?	

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)
IAC0108	Young plant growth and development stages are described in terms of the practices and procedures that are implemented at those stages	B5, B6, B7, C2, E1