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Citrus Orchard Foreman Occupational Learning

Work Scenario Guide

D1: Nutrition Monitoring

Qualification:	110667 – Occupational Certificate: Orchard and Vineyard Foreman
Work Scenario:	D1: Nutrition Monitoring
Learning Area:	D: Oversee the monitoring of plant health
Scenario Description:	You are walking through your orchard, and notice some of the trees are looking unhealthy. To assess the health and nutritional status of your trees, you need to be able to gather data.

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Alignment Information

Qualification

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

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

Modules

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

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

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

Learning Outcomes

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

Knowledge Topics	
Outcome Code	Module Title
KM-02-KT03	Block establishment
IAC0303	The process of making a profile hole is outlined and the data which can be obtained is listed
KM-05-KT01	Crop Nutrition
IAC0103	Nutrient deficiencies are explained in terms of symptoms, causes and corrective actions
KM-05-KT03	Sampling procedures
IAC0301	Methods of measuring nutritional status of plant through analysis (leaf, soil and fruit) are outlined
IAC0302	Sampling methods (soil, leaf, and fruit) are discussed in terms of merits and appropriate application
IAC0303	The practical use of soil and leaf analysis reports is explained
KM-05-KT05	Irrigation
IAC0508	The use of irrigation scheduling equipment in measuring soil water status is described
KM-06-KT01	Principles of integrated pest and disease management
IAC0112	The different monitoring methods for pests and diseases are described
IAC0113	The monitoring measures are described in terms of the time during the season and location in the block or on the plant
IAC0115	Role of the monitor is outlined
KM-06-KT02	Identification of pests, diseases and weed
IAC0201	The main symptoms or characteristics of diseases, pests and weeds are identified
IAC0202	Confusing symptoms of nutritional deficiencies and toxicity with pests and diseases are discussed
IAC0204	The phase of the pest life cycle which causes the damage is described
IAC0206	The favourable environmental factors promoting the occurrence of pests, diseases and weeds are described
Practical Skills	
PM-03-PS01	Perform a practical exercise to verify orchard and production information related to occurrence of pests and diseases, crop quantity and size and production tasks based on case study information
IAC0101	The correct records related to chemicals, pest and diseases and crop quality and quantity is presented
IAC0102	Availability is compared against industry standards or the information of the previous year
IAC0103	Actions are taken in compliance with IPM regulations and the provided plan of action

PA0101	Determine crop quantity and size with the production task
PA0102	Verify all records kept of production tasks
PA0103	Verify accuracy and completeness of the production records
PA0104	Verify the compliance of the production records with accreditation / traceability requirements
PM-03-PS03	Scout to ascertain crop health
IAC0301	The scouting plan is followed to specification
PA0301	Read and interpret the scouting plan
PA0302	Decide on the applicable scouting procedure
PA0303	Scout a Vineyard or orchard to ascertain plant health and its impact on production tasks and achievement of production targets
PA0304	Interpret scouting information and the implication for operations

Chapter 1

Plant Health Monitoring

learning outcomes

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

- Monitor plant health through sampling.
- Identify and interpret symptoms of nutritional deficiencies.

1. Plant Health Monitoring

Citrus trees require a wide range of nutrients to grow healthily and to live long, productive lives. When too little of any of these nutrients is being supplied to a tree, we call this a deficiency. These deficiencies are usually first noticed by looking for deficiency symptoms.

Deficiency symptoms develop as a result of a physiological process that cannot be completed. These symptoms will usually appear about six weeks after the nutritional deficiency occurs. This means that using nutritional deficiency symptoms to prepare a nutritional program is acting too late, as the deficiency has already been hurting the tree for weeks, if not months.

Therefore, you should do your best to avoid deficiencies, and you should have strategies to continuously monitor the nutritional status of your trees, so that any deficiencies can be picked up quickly, before symptoms develop. A common (and recommended) way of monitoring tree health is to perform regular leaf and soil analyses.

While sampling is important, it is not a guarantee of perfect monitoring. It is possible for the concentration of certain nutrient elements to drop to "below normal" and even "deficient" levels without being noticed in the sampling process.

Because of this, it is important that you use scouts to monitor the trees in the orchard for these 'hidden' deficiencies. Their observations must then be reported when supplying orchard information to the person preparing the fertilisation program.

In this material, we discuss sampling, as well as monitoring, and the various deficiency symptoms you and your scouts may uncover.

2. Soil and Leaf Samples

Soil samples can be taken at any time (except after an application of fertilisers), but they have little value in diagnosing or confirming a nutrient deficiency symptom. In commercial citrus production, fertilisers are applied from July to December and, in certain cases, even as late as February. This means that soil sampling is only reliable between February and June, and which gives a limited window for when to judge plant health. Soil samples are still useful, as they aid in creating the fertilisation program for the coming season.

Leaf samples are generally taken from February to May to evaluate the nutritional status of citrus trees. You can take leaf samples to confirm a deficiency during other times of the year, but you should be careful not to be overly reliant on these results. Leaf samples are done by selecting a specific leaf type, at a specific position on the tree, at a specific physiological stage. This is called the diagnostic leaf.

Leaf sampling has the issue that deficiency symptoms usually develop on old or young leaves first, which can make it difficult to judge the severity or cause of the issue. This means that leaf analyses sometimes fail to detect the deficiency and taking leaf samples can have limited value. Other factors such as the total biomass produced can also complicate the interpretation of the results.

3. Symptoms of Nutrient Deficiencies

This weakness of sampling means that it is good practice to use visual scouting to monitor your trees continuously throughout the year. Scouts must be trained to look for specific symptoms, which we discuss below. The most common nutrient elements that develop hidden deficiency symptoms are nitrogen, magnesium, copper, and iron.

3.1. Nitrogen

Nitrogen is a mobile nutrient in plants, meaning that it moves around the plant to areas where it is required the most. The nitrogen in old leaves is relocated to new leaves shortly before the old leaves are dropped. This is a natural process which starts when the leaves are about twenty-four months old.

Leaves under the age of twenty-four months can however be dropped prematurely when the tree experiences a shortage of nitrogen, with the nitrogen from these leaves relocated to younger leaves on the same or other twigs.

The leaves receiving the relocated nitrogen will have an elevated concentration, but at the cost of the older leaves. If the leaves with elevated nitrogen concentration are picked during sampling, the leaf analysis will present an inaccurate reflection of the nitrogen status of the trees. The actual nitrogen status is disguised by relocating nitrogen.

The symptoms of this nitrogen relocation process (and thus a possible nitrogen deficiency) that your scouts should look for are:

- The entire tree being a slightly lighter green than normal
- The oldest leaves turning a deep yellow colour and dropping
- Twigs having leaves at the tips and few or none at the middle or base
- The tree being sparsely foliated with only one or two generations of leaves
- Excessive leaf-drop occurring a week before and during a vegetative flush

During a deficiency, the nitrogen concentration in the leaves decreases but stabilises at a level in the "below normal" range, which hides the true deficiency by relocating nitrogen from leaves dropped prematurely. Therefore, a few leaves on the tree will have a reasonable nitrogen status, but this "fairly good" status is not true for most of the leaves and the tree as a whole.

3.2. Magnesium

Magnesium is also a mobile nutrient, and a similar process of magnesium relocation occurs when the supply of magnesium is too low. Magnesium deficiency symptoms are more prominent on seeded cultivars.

The symptoms of magnesium relocation (and thus a possible deficiency) are:

- No change in the green appearance of the entire tree
- The oldest leaves developing yellowing from the sides and tip backwards towards the petiole, leaving a unique inverted V-shaped green area with its broadest side at the petiole

- Twigs having leaves at the tips and few or none at the middle or base
- The tree being sparsely foliated with only one or two generations of leaves
- Excessive leaf-drop occurring during the onset of spring and/or during a vegetative flush
- Excessive leaf-drop occurring after a foliar application of potassium, as applications of potassium will aggravate the hidden magnesium deficiency

As with nitrogen, the magnesium concentration in the leaves decreases but stabilises at a level in the “below normal” range, which hides the true deficiency by relocating magnesium from leaves dropped prematurely. Therefore, a few leaves on the tree will have a reasonable magnesium status, but this “fairly good” status is not true for most of the leaves and the tree as a whole.

3.3. Copper

Copper moves slowly through the citrus tree. When a strong vegetative flush develops, the supply of copper to the leaves formed on the new twigs might be too low and copper deficiency symptoms may develop. The typical leaf symptom for a copper deficiency are abnormally large leaves. This will be most noticeable at the base of a twig, with the basal leaves being two to four times their normal size, and are sometimes ‘boat-shaped’.

During the days after the strong vegetative flush, the supply of copper may increase and will reach the “normal” level in the affected leaves, but the deficiency symptom will remain. When copper deficiency symptoms appear on leaves of a twig exceeding 50cm in length, it can be attributed to a natural slow supply of copper. However, if symptoms appear on shorter twigs, the copper supply must be supplemented.

Gumming is often connected to a copper deficiency, but gumming is a natural response of the tree to many adverse conditions and not only a copper deficiency. This means that if your scouts see gumming, they should make a note of it, but it may not necessarily be a copper deficiency.

definition

Gumming

Gumming refers to the excretion of gum in droplets or patches. It can occur as a result of deficiencies such as a copper deficiency but may also be due to injuries or adverse climatic conditions such as frost, heat and drought.

3.4. Iron

Iron is present in leaves in both physiologically active and inactive forms. This means that some of the iron in the leaves cannot actually be used by the leaves. Traditional leaf analyses cannot distinguish between these forms and only indicates the total iron content, which means it is not always a useful way of determining an iron deficiency.

The availability of the iron in the soil depends on external factors such as soil pH and the concentration of bicarbonates in the soil, the water and the plant. When the soil pH is high, less iron is available to be taken up by the plant. Once taken up, the iron can be inactivated by bicarbonates.

Bicarbonates are present in the irrigation water, but also in the cell-sap in the plant. Inactive iron accumulates in the leaves and forms part of the iron concentration

detected during analysis. This means a plant can suffer an iron deficiency although the leaf analysis indicates normal, high or excess concentrations of iron.

Iron is not relocated in the plant and deficiency symptoms develop on the newly formed leaves. The symptoms are more prominent during winter and at the lower shaded part of the canopy. A typical symptom of iron deficiency is the development of a light green leaf blade with prominent green veins spread over the entire leaf. Even the very fine veins remain green on a yellow background.

3.5. Other Deficiency Symptoms

On the following page is a table containing complete details of all the various nutrient deficiency symptoms in citrus, including mild and severe expressions of deficiencies.

information

Nutrient Deficiency Symptoms

<i>Nutrient Element</i>	<i>First Plant Part to Display Symptoms</i>	<i>Mild Expression</i>	<i>Severe Expression</i>
Nitrogen (N)	Old leaves	Yellowing of all the old leaves, to a light-yellow colour.	Yellowing of all leaves just before or during a new leaf flush which will result in leaf drop.
Phosphorus (P)	Fruit	Open centre resembling over-matured fruit.	Thick skins and puffy fruit with high acid levels.
Potassium (K)	Fruit	Small fruit	Small fruit with thin skins combined with a low yield. On young trees the leaves may turn bronze.
Calcium (Ca)	Fruit	Increase incidence of creasing, which is a physiological disorder. This has however not been confirmed yet.	Chlorosis (yellowing) of very young leaves and dieback of growth tips.
Magnesium (Mg)	Old leaves	Chlorosis of the front part of the leaf from the tip and sides of the leaf. An inverted green V with the open end of the V at the petiole side appears as the symptom develops.	Leaf drop and decrease in fruit set.
Sulphur (S)	New leaves	Yellowing to the colour of butter of emerging leaves on a green twig.	Extremely reduced fruit set.
Copper (Cu)	New leaves	Extra-large leaves on strong new growth.	Gum pockets in the albedo (white part of the peel) of the fruit. Fruit is small, thin skinned and hard.

Iron (Fe)	New leaves	Yellowing of the lamina (leaf blade) of young leaves leaving a well-defined network of veins.	Reduced fruit set.
Manganese (Mn)	New leaves	Inter-veinal yellowing of a normal-sized leaf, almost over the entire leaf. Broad green areas around the veins and chlorotic areas between veins are the most obvious symptoms.	Increase in the number of leaves affected.
Zinc (Zn)	New leaves	Interveinal yellowing of a small-sized leaf, starting at the tip of the leaf. Resembles manganese deficiency but appears on small leaves and the chlorosis starts at the tip of the leaf.	Increase in the number of leaves affected and reduction in fruit size.
Boron (B)	New leaves	Corking of the midrib vein on the underside of the leaves. This resembles the symptoms of cold damage on leaves.	Gum pockets around the centre of the fruit. Fruit size is reduced.

summary

Chapter 1 – Plant Health Monitoring

- A nutrient deficiency is when a tree is getting too little of a nutrient it needs.
- Nutrient deficiency symptoms usually appear about six weeks after the nutritional deficiency occurs.
- Nutritional deficiency symptoms should never be used as the basis for developing a fertilisation program, because the deficiency would already have had an adverse effect on production.
- Leaf and soil analyses are used to identify deficiencies, but must be supplemented with visual monitoring.
- Leaf samples are usually taken from February to May to evaluate the nutritional status of citrus trees. Taking leaf samples to confirm a deficiency during other times of the year must be done cautiously.
- The most common deficiency symptoms are for nitrogen, magnesium, copper and iron.
- Deficiency symptoms must be used in conjunction with analyses to develop a nutrient management program, with specific remedies for specific deficiencies.

assessment activities

- ✓ **Activity P1:** Complete this activity to test your knowledge of plant health monitoring.
- ✓ **Activity F1:** Complete this activity to test your knowledge of the entire module.