



Citrus Orchard Foreman Occupational Learning

Work Scenario Guide

E2: Fertigation

Qualification:	110667 – Occupational Certificate: Orchard and Vineyard Foreman
Work Scenario:	E2: Fertigation
Learning Area:	E: Implement plant nutrition activities
Scenario Description:	You have decided that your trees need to be supplied with extra nutrients, and you have decided that they need to be applied via fertigation. You need to oversee and monitor the application of fertigation products by your workers to ensure that fertigation is performed safely, effectively, and efficiently.

© Citrus Academy 2026

1st edition (06/2026)

Content originator:
Citrus Academy

Occupational alignment:
Ukudla Namanzi (Pty) Ltd

Disclaimer

By accepting this document and reading its contents you agree to be bound by the terms of this disclaimer.

The use of the contents of this document is at your own risk. Neither the Citrus Academy NPC nor Citrus Research International (Pty) Ltd or the Citrus Growers' Association NPC warrant that the content of this document is suitable for your intended use or that it is free of inaccuracies or omissions. The opinions and advice expressed in this document are not necessarily those of the Citrus Academy NPC, Citrus Research International (Pty) Ltd or the Citrus Growers' Association NPC. The Citrus Academy NPC, Citrus Research International (Pty) Ltd and the Citrus Growers' Association NPC, their directors, officers, employees, agents and contractors shall not be liable for any loss or damage of any nature suffered by any person as a direct or indirect result of the use of, or inability to use any advice, opinion or information contained in this document, or any misrepresentation, misstatement or omission, whether negligent or otherwise, contained in this document.

You indemnify the Citrus Academy NPC, Citrus Research International (Pty) Ltd and the Citrus Growers' Association NPC against any claim by any third party against the Citrus Academy NPC, Citrus Research International (Pty) Ltd or the Citrus Growers' Association NPC, their directors, officers, employees, agents or contractors arising from, or in connection with, the use of, or reliance on, the contents of this document. It is your responsibility to determine suitability of the contents of this document for your intended use.

Contents

Alignment Information	4
Qualification	4
Modules	4
Learning Outcomes	5
Chapter 1 Fertigation	6
1. Fertigation	6
2. Fertigation Process	7
3. Fertigation System Maintenance	8
4. Fertigation Safety	9

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-05-KT01	Crop Nutrition
IAC0106	Nutrient application methods are described
Practical Skills	

Chapter 1

Fertigation

learning outcomes

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

- Manage and implement fertigation.

1. Fertigation

Fertigation is the process of applying fertiliser through the irrigation system, using the irrigation water to carry and spread the fertiliser through the orchards. Fertigation can be performed seasonally on a weekly or monthly basis, or it can be a continuous process of injecting a balanced fertiliser mix during each irrigation cycle. This second 'continuous injection' approach is referred to as 'hydroponics', and is almost exclusively used with drippers and pressure compensated drippers.

For fertigation to work, the irrigation system must be designed for it. The main factor is that the system must have a good coefficient of uniformity. Micro-jets and drippers that are well maintained will usually have a good coefficient of uniformity. These systems also consist largely of PVC, polyethylene and plastic components that are resistant to the corrosive nature of fertiliser. Where components and pipes are made of steel or asbestos cement, fertigation should not be attempted without consulting an expert.

The fertilisers used for fertigation are usually sold in a liquid or water-soluble powder form. Note that for fertigation to work, the fertiliser must be able to dissolve completely in water, and so not all fertilisers can be used for fertigation. Further, some fertilisers cause precipitates that can block pipes and emitters.

A few of the fertilisers usually suitable for fertigation are:

- Ammonium phosphate
- Ammonium sulphate
- Magnesium sulphate
- Magnesium nitrate
- Calcium nitrate
- Potassium nitrate
- Urea

Micro-elements can also be added to the fertigation water in water-soluble forms. The simplest fertigation systems have one tank where one type of fertiliser (or multiple compatible fertilisers) is added. Compatible fertilisers are different types of fertilisers that can be mixed in the same tank in a concentrated form. More advanced systems have two or three tanks, depending on the compatibility of the fertilisers and whether acids are introduced.

Certain types of fertilisers cannot be mixed, as the chemical reaction that will take place in the tank will cause the formation of insoluble salts. These are incompatible fertilisers. An example of incompatible fertilisers are sulphate products, which are incompatible with

calcium products, as calcium and sulphate form calcium sulphate (gypsum) which is insoluble.



Fertigation Tanks

The setting up of a fertigation system requires the help of a fertigation expert, who can advise you or farm management on the appropriate choice of system and dosage technique. Further, they can assist in the selection and creation of fertigation programs and specific mixes of agrochemicals. Finally, they can provide knowledge on the effective management of fertigation.

Fertigation schedules are very important for selecting the correct product(s) and tank mixtures. As we've said, fertigation experts can assist in creating these, as they are very knowledgeable about various chemical mixtures and reactions and the resulting effects on crops.

2. Fertigation Process

There are a few different ways that the fertiliser can be introduced to the irrigation water, depending on the specific equipment and infrastructure available, as well as the system being used.

Firstly, you can directly feed the fertiliser from the tank into the suction side of the pump. This is the simplest and cheapest option, but it is not recommended. The fertiliser mix can corrode the inside of the pump and the risk of the pump sucking air increases.

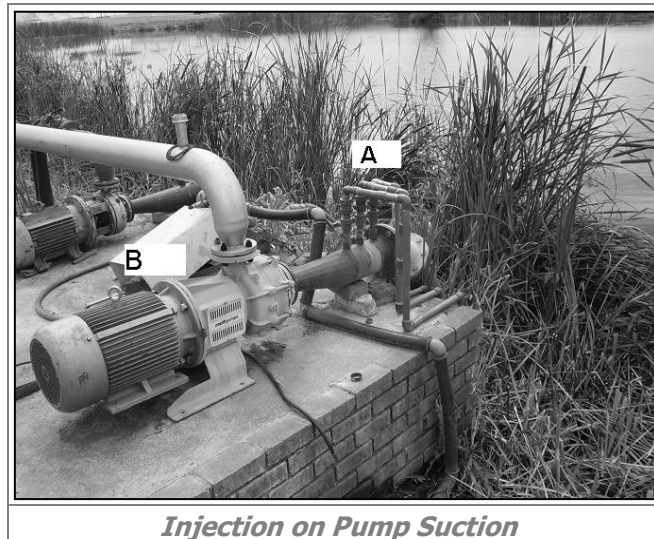
Further, you may use venturis (see figure 1.3), which are devices that lower the pressure in a pipeline to below atmospheric pressure, creating a pressure difference, and sucking fertilisers from the mix tanks. Using the venturi method is fairly inexpensive and simple, but creates a large pressure drop in the system, which can be problematic for certain systems.

For some (usually larger) systems, electric pumps can be used. These pumps can be diaphragm, plunger, or centrifugal pumps. The pumps inject the fertiliser mix into the high-pressure side of the system (after the water pump), at a pressure greater than the system pressure. Pumps work very well and can be regulated accurately, but they are expensive to install and maintain, and use electricity.

Another option is using water-powered dosing pumps, which use the system pressure to dose the fertiliser mix into the irrigation water. Dosing pumps are accurate, but like electric pumps, expensive. Dosing pumps can also cause a small amount of pressure or water loss.

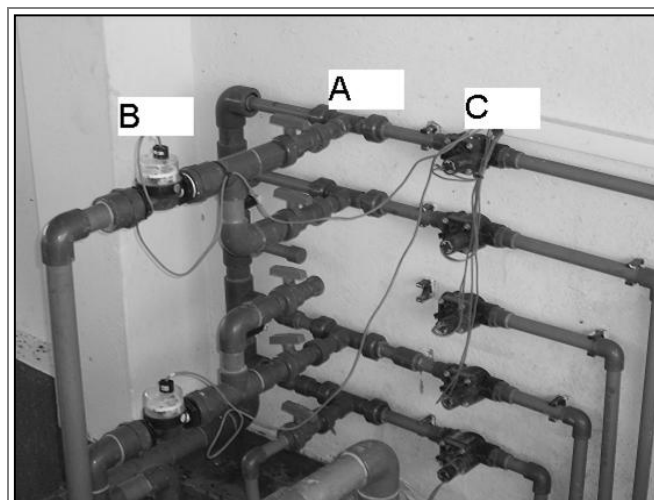
Finally, you can use a pressurised tank that allows for the use of soluble solids. In these systems, a small stream of water is used to dissolve the fertiliser, after which this solution is carried into the system.

Below is an example of an injection on a pump suction, where "A" is the chemical injection on the suction side of the pump and "B" is the pump.



Injection on Pump Suction

Below is an example of a venturi system, where "A" is the bank of Venturi's, "B" is the flow meter to measure the amount of fertiliser applied, and "C" is the solenoid valve that controls the injection of the fertiliser.



Venturi System

3. Fertigation System Maintenance

More advanced fertigation systems, such as open hydroponics, are monitored and controlled by computers. Usually, these systems incorporate pH and EC meters. pH meters are used to ensure that the water is in the optimum pH range of 5.6 to 6.2. The EC (electrical conductivity) meter is used to measure the concentration of fertiliser in the water.

These complex fertigation systems require intensive management. However, it is very important to keep records of all tank mixes, the types of fertilisers used, flowrates, and operations, even for the smallest fertigation system.

The following maintenance is required on fertigation systems:

- Regular inspection of the inline filters and valves for blockages and correct operation
- Regular inspection of flow, pH, EC meters and computer for correct operation
- Annual opening and cleaning of pumps, tanks, valves, and equipment

Always remember that many types of fertiliser are corrosive, so if equipment is to be stored for a long time, it should be rinsed and filled with clean water first. Fertigation programs must be adapted when the water quality changes. The adaptation of fertigation programs should always be done in consultation with a fertigation expert.

Droughts or excessively rainy periods are a particularly important period in terms of fertigation. Firstly, during droughts, water tends to be more saline. If the water becomes too saline, fertigation should be suspended.

When irrigation is reduced, such as during excessive rain, fertigation should be reduced or stopped. The reduced irrigation can increase the concentration of salts in the soil, which can be exacerbated by fertigation. This increase in salts can be harmful to plants by burning the plant roots and inhibiting water absorption.

During periods of prolonged rain nutrient leaching can also occur. Though this leaching can sometimes be desirable, often it may mean that nutrient levels must be boosted. This may require increased fertigation. Once again, these changes should be done in conjunction with an expert.

4. Fertigation Safety

Fertigation systems use corrosive and concentrated chemicals, some of which can be dangerous if not handled properly. Whenever you work with any agrochemicals, you should always take proper care and act safely. Certain agrochemicals, including some used in fertigation, can cause acid burns, breathing difficulties from vapours, and poisoning.

When working with any agrochemicals, you and your workers should always wear appropriate protective clothing. This clothing includes:

- Rubber gloves
- A clean pair of overalls
- Rubber boots
- A respirator or dust mask
- Goggles or a full-face mask

When you are mixing or handling chemicals, you must always treat all chemicals with respect. It is better to act as if every agrochemical is possibly harmful, so that you are always being as safe as possible.

When transporting and storing agrochemicals, you must keep them separate, so that they do not mix. For storage, it is very important to store different types of chemicals separately and never in the same area. For example, keeping a certain agrochemical in the workshop may cause tool corrosion, or keeping it near fuel may cause an explosion. For mixing, you should always add chemicals to water and not water to chemicals. Containers should not be reused for mixing different chemicals or transporting.

Finally, you should have a detailed, well-designed chemical safety plan and procedures, in the form of a written document. This document must be made available to all staff members, and they should be made well aware of its requirements. Drills and mock emergencies should be practised to familiarise staff with the safety plan. The safety plan can also be incorporated into the other safety plans on the farm, such as the fire drill and the poison safety plan.

The chemicals safety plan and procedures must cover several areas. Firstly, it must cover and ensure proper recordkeeping of all chemical handling, including the name of the person working with the chemicals, the purpose, and the time and date. These records can be integrated with the existing recordkeeping system. The safety plan should also describe proper safety procedures, as set out above.

The safety plan must also include emergency drills in case of injury, spillage, or fire. In case of injury or poisoning, you should remove the injured person from the area, then wash the area on the skin that came in contact with the chemicals with water. If chemicals came into the eyes or face, wash with water or milk. If the injured person inhaled chemicals and has stopped breathing, perform CPR. If any chemicals were swallowed, do not induce vomiting but seek medical assistance first.

In case of spillage or fire, proper protective clothing should be worn when dealing with the emergency (such as fireproof clothing or hazmat suits). The spill can usually be contained by creating a dam or using an agent like sand to soak up the chemical. For fires, ensure that you use a fire extinguisher suitable for chemical fires.

summary

Chapter 1 – Fertigation

- Fertigation is the process of applying fertiliser through the irrigation system, using the irrigation water to carry and spread the fertiliser through the orchards.
- Fertigation can be performed seasonably on a weekly or monthly basis, or it can be a continuous process, referred to as 'hydroponics'.
- The fertilisers used for fertigation are usually sold in a liquid or water-soluble powder form.
- Micro-elements can also be added to the fertigation water in water-soluble forms.
- Compatible fertilisers are different types of fertilisers that can be mixed in the same tank in a concentrated form.
- The setting up of a fertigation system requires the help of a fertigation expert.
- There are a few different ways that the fertiliser can be introduced to the irrigation water, including direct introduction into the irrigation pump, specialised fertigation pumps, and venturis.
- More advanced fertigation systems, such as open hydroponics, are monitored and controlled by computers.
- Fertigation programs must be adapted when the water quality changes.
- Fertigation systems use corrosive and concentrated chemicals, some of which can be dangerous if not handled properly.
- When working with any agrochemicals, you and your workers should always wear appropriate protective clothing.

- You should have a detailed, well-designed chemical safety plan and procedures, in the form of a written document.

assessment activities

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