



Citrus Orchard Foreman Occupational Learning

Work Scenario Guide

E1: Irrigation Scheduling

Qualification:	110667 – Occupational Certificate: Orchard and Vineyard Foreman
Work Scenario:	E1: Irrigation Scheduling
Learning Area:	E: Implement plant nutrition activities
Scenario Description:	Once you have considered all the necessary factors to determine the appropriate amount of irrigation for your trees, you need to create and implement irrigation schedules for workers to use.

© 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 Irrigation Scheduling	6
1. Irrigation Scheduling	6
2. Monitoring the Irrigation Schedule	6
3. Determining the Effectiveness of Irrigation	7
3.1. The Coefficient of Uniformity	7
3.2. Scheduling Equipment Data	7
3.3. Profile Pits	8
3.4. Tree Health	8
3.5. Crop Yield Data	8
4. Adapting Irrigation Schedules	8

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-KT05	Irrigation
IAC0506	Irrigation scheduling in different climatic and weather conditions and stages of fruit production is outlined and motivated
Practical Skills	

Chapter 1

Irrigation Scheduling

learning outcomes

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

- Create and modify irrigation schedules in response to varying irrigation needs.

1. Irrigation Scheduling

For an irrigation system to run effectively, it is important that all irrigation is performed under a well-planned irrigation schedule. The main aim of scheduling is to maintain the soil water balance at the optimum levels. You should never allow the soil to be too wet, as these anaerobic conditions and waterlogging will inhibit plant performance. Soil that is too dry is also a problem, as your plants will suffer from water stress.

A soil analysis is done to determine field water capacity and the permanent wilting point for the soil type. These indicate the upper and lower limits of the soil water reservoir. After this a profile hole is made to determine the effective root depth of the plants. On crops that are replanted annually, one can use existing crop data to determine root depth. Using the above data the plant available water and the easily available water can be calculated.

For micro-jets, this ideal soil water balance will fluctuate between FWC and -50kPa, and for drippers the soil water balance should be between 15kPa to 25kPa. Using this information, you can determine the correct stand time and irrigation frequency (or cycle). This information will form your irrigation operations schedule.

An irrigation operations schedule consists of:

- The **table of operations**, which lists the different operations, and the blocks involved in each operation.
- The **irrigation schedule**, which lists the date and stand time for each operation. The longer the stand time, the more water applied, especially during hot periods.
- List of **pressures and flows**, which are used to set the pressure for each block.

For the irrigation system to operate effectively, these three components must all be managed properly. You may need to contact an irrigation expert or other expert to assist in developing this schedule, as you may require additional testing such as soil sampling done in a laboratory, and you may be unfamiliar with how to work out some of these figures.

2. Monitoring the Irrigation Schedule

Once the schedule has been created and implemented, you need to consistently monitor the irrigation to judge the effectiveness of the schedule. Various tools and aids are available to you to assist in the monitoring, including E-pans, rain meters, tensiometers, and probes. This equipment provides information that assists with the calculation of the soil-water balance, thereby enabling one to determine the effectiveness of the irrigation.

example

Irrigation Scheduling

Farmer Brown has a citrus farm. The micro-jet irrigation system has an application rate of 2mm/h. With the current schedule, each block is irrigated for 4 hours every second day. There is no irrigation on day 7. This means that farmer Brown applies 8mm of water during every operation, irrigating a total of 24mm a week.

According to the E-pan, the average evaporation (E_o) is 3.4 mm/day, being 23.8 mm/week. The irrigation intervals are therefore adequate for the moment. He would also observe an adequate water balance according to the readings from the tensiometers and the probes. These instruments will show that the soil-water balance is kept between FWC and the -50kPa or the refill point.

Should the climate become warmer, the daily E_o will rise. The probe and the tensiometer readings will also start to indicate the soil-water balance is nearing -50kPa or the refill point quicker. The intervals must now be decreased until the tensiometer and probe readings show the soil-water balance to be in the correct range. The same principle would also apply for cooler seasons, when the scheduling equipment would indicate a lower evapotranspiration, and the intervals will have to be increased accordingly.

3. Determining the Effectiveness of Irrigation

The effectiveness of irrigation can be assessed in numerous ways, but the most reliable way is to use a combination of the following factors to measure the effectiveness:

- Coefficient of Uniformity (CU) tests
- Scheduling equipment data
- Visual inspection of profile pits
- Tree health
- Crop yield data

Again, you shouldn't use any of these factors in isolation to determine the irrigation effectiveness, as this may skew the results. For instance, if the CU and profile pits show a high effectiveness, but the yield is low, other factors influencing yield must be investigated. On the other hand, if tree health is poor in certain areas and the profile pits data vary greatly, the cause of poor irrigation effectiveness must be investigated.

3.1. The Coefficient of Uniformity

In previous material, we discussed CU tests and how they can be used to determine the effectiveness of the irrigation system and the performance of irrigation equipment. The CU test also indicates the delivery rate of the emitters, which is critical in determining the exact volume of water that is delivered to the trees and whether there is a uniformity of delivery.

3.2. Scheduling Equipment Data

Data obtained from scheduling equipment, especially equipment such as probes and tensiometers, also indicates the volume of water being put down in the soil as well as the depth of the wetted profile. This data can be compared to the actual water meter readings for the specific block. In this manner, the effectiveness can be determined as it indicates losses due to evaporation and misting during irrigation.

3.3. Profile Pits

Digging and inspecting profile pits can help to determine irrigation effectiveness. Although no readings can be taken, it offers the opportunity to determine the depth and width of the wetted profile as well as a visual inspection of root growth and health. Good root growth and health indicate that the profile is wetted correctly and consistently, while bad root health can be attributed to poor irrigation (under- or over-irrigation).

Profile pits are also useful to determine if waterlogging occurs, especially at subsoil-levels. Profile pits can be used to evaluate the effectiveness of the stand time and irrigation cycle. Stand times that are too long generally cause waterlogging and wetting the profiles below the root-zone. Stand times that are too short will show up as shallow wetting of the upper crust.

Excessively long cycles are more difficult to detect, but can manifest as a dryer profile with deep roots and dry subsoil. Excessively short cycles will result in either a profile being too wet, or salt accumulating due to lack of leaching. Evaporative losses will also be higher.

3.4. Tree Health

General tree health is a subjective method of determining irrigation effectiveness. Although some skill and experience are required in assessing tree health and the general condition of the trees, it is a useful method of assessing whether the whole orchard is over- or under-irrigated.

You must however keep in mind that tree health is influenced by a wide range of production factors and that trees usually show only symptoms of over-irrigation when the problem is in an advanced stage and difficult to correct. It is also possible to identify problem areas in a specific orchard by assessing variances in tree health. Symptoms such as wilting, colouring and turning of the leaves can be indicative of poor irrigation practices.

3.5. Crop Yield Data

Yield data can indicate if irrigation effectiveness is poor or good, but is also influenced by a wide range of production factors making it difficult to isolate the effect of irrigation. Yield is influenced by factors such as fertilising, pruning and pest control, but can also be indicative of irrigation effectiveness over a longer period of time. Fruit being too small at harvest is often an indication of poor irrigation management, provided that plant nutrition and fertilisation are ruled out as causes.

4. Adapting Irrigation Schedules

Even once an irrigation schedule has been developed and implemented, your job is not necessarily finished. Different crops have different water requirements and to meet these requirements, irrigation scheduling must be adapted according to the crop. In addition, in the same way that citrus have different water requirements for different tree ages and physiological stages, so do other crops have different water requirements depending on age and season.

The operations table, pressure and flows table and the irrigation schedule must be known or obtained from the irrigation design. Using the available scheduling equipment, the irrigation stand-time and cycles must be adapted to suit the crop water requirements. In the table below the process is summarised.

information

Adapting Irrigation Scheduling

<i>Step</i>	<i>Item</i>	<i>Method</i>
1	Field water capacity (FWC)	Determine through lab tests or with scheduling equipment such as tensiometers and probes
2	Permanent wilting point (PWP)	Determine through lab tests or with scheduling equipment
3	Effective root depth (ERD)	Determine by digging a profile hole
4	Plant available water (PAW)	Estimate using formula PAW = FWC – PWP
5	Easily available water (EAW)	Estimate using formula EAW = PAW x ERD x 50%
6	Crop water requirement	Calculate from soil water balance or use industry information
7	Operations table, pressure and flow table, irrigation schedule	Obtain from irrigation design
8	Optimise scheduling	Use scheduling equipment such as E-pans, probes and tensiometers to optimise the stand time

summary

Chapter 1 – Irrigation Scheduling

- The main aim of scheduling is to maintain the soil water balance at the optimum levels.
- A soil analysis is done to determine field water capacity and the permanent wilting point for the soil type.
- A profile hole is made to determine the effective root depth of the plants.
- An irrigation operations schedule consists of the table of operations, the irrigation schedule, and the list of pressures and flows.
- Various tools and aids are available to you to assist in irrigation monitoring, which provide information that assists with the calculation of the soil-water balance.
- The effectiveness of irrigation can be assessed by viewing the results of CU tests, scheduling equipment data, visually inspecting profile pits, and assessing tree health and yield data.
- Different crops have different water requirements and to meet these requirements, irrigation scheduling must be adapted according to the crop.

assessment activities

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