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# Citrus Orchard Foreman Occupational Learning

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## Study Guide

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### KM-07: Assets in Horticultural Production

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|-----------------------|-----------------------------------------------------------------|-----------------|---|
| <b>Qualification:</b> | 110667 – Occupational Certificate: Orchard and Vineyard Foreman |                 |   |
| <b>Module No.:</b>    | 611202001-KM-07                                                 |                 |   |
| <b>Module Title:</b>  | Assets in Horticultural Production                              |                 |   |
| <b>NQF Level:</b>     | 3                                                               | <b>Credits:</b> | 2 |

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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 |
|--------------------------------|-----------------------------------------------------------------------------|-------|---------|
| <b>Knowledge Modules</b>       |                                                                             |       |         |
| 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       |
| <b>Practical Skill Modules</b> |                                                                             |       |         |
| 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                                                                                                                                 |
| <b>KM-07-KT01</b>                          | <b>Assets (34%, 0.68 credits)</b>                                                                                                     |
| KT0101                                     | On-farm assets                                                                                                                        |
| KT0102                                     | Requirements for on-farm infrastructure, systems, tools, equipment and machinery used in fruit/grape production                       |
| IAC0101                                    | On-farm assets are listed and defined                                                                                                 |
| IAC0102                                    | The life cycle of an asset is described                                                                                               |
| IAC0103                                    | Value of an asset to the farm is evaluated                                                                                            |
| IAC0104                                    | Types of on-farm infrastructure, systems, tools, equipment and machinery used in fruit/grape production are described                 |
| IAC0105                                    | An inventory of tools, equipment and maintenance items is compiled                                                                    |
| IAC0106                                    | The basic principles of agricultural mechanisation are outlined                                                                       |
| IAC0107                                    | The application of OSH act related to equipment and infrastructure is explained                                                       |
| <b>KM-07-KT02</b>                          | <b>Use and storage of on-farm infrastructure, systems, tools, equipment and machinery (33%, 0.66 credits)</b>                         |
| KT0201                                     | Use of on-farm infrastructure, systems, tools, equipment and machinery                                                                |
| KT0202                                     | Storage of on-farm tools, equipment and machinery                                                                                     |
| IAC0201                                    | Fundamental principles of equipment use and abuse are listed                                                                          |
| IAC0202                                    | Methods of monitoring maintenance, sanitation and storage of tools and equipment are described                                        |
| IAC0203                                    | Methods of monitoring the condition of infrastructure and determining the need for repairs or maintenance are discussed               |
| IAC0204                                    | The importance of monitoring and maintenance of machines and equipment is explained                                                   |
| IAC0205                                    | Storage requirements for a range of on-farm tools, equipment and machinery                                                            |
| IAC0206                                    | The importance of compliance with sound storage requirements are justified                                                            |
| IAC0207                                    | The effect of poor storage activities on the serviceability of on-farm tools, equipment and machinery is analysed                     |
| <b>KM-07-KT03</b>                          | <b>Maintenance of on-farm infrastructure, systems, tools, equipment and machinery (33%, 0.66credits)</b>                              |
| KT0301                                     | Maintenance principles                                                                                                                |
| KT0302                                     | Maintenance of on-farm infrastructure and the systems, tools, equipment and machinery used in crop production                         |
| KT0303                                     | Condition of assets                                                                                                                   |
| IAC0301                                    | Principles of optimum efficiency of machines and equipment and the effect on the durability of the asset and production are described |
| IAC0302                                    | The effect of wear and tear on the durability of the machines and equipment is analysed                                               |
| IAC0303                                    | Principles of scheduled maintenance are evaluated                                                                                     |
| IAC0304                                    | Breakdown of machinery and equipment and the effect of down time is analysed                                                          |
| IAC0305                                    | Critical factors for working condition of infrastructure are outlined                                                                 |
| IAC0306                                    | Principles of agricultural equipment maintenance are outlined                                                                         |

|         |                                                                                                                         |
|---------|-------------------------------------------------------------------------------------------------------------------------|
| IAC0307 | The use of production plans to determine tools, equipment and machinery needs and maintenance requirements is explained |
| IAC0308 | Infrastructure maintenance plans are discussed                                                                          |
| IAC0309 | Methods of monitoring maintenance, sanitation and storage of tools and equipment are described                          |
| IAC0310 | Critical factors for working condition of infrastructure are outlined                                                   |
| IAC0311 | Methods of monitoring the condition of infrastructure and determining the need for repairs or maintenance are evaluated |
| IAC0312 | Infrastructure maintenance plans are discussed                                                                          |
| IAC0313 | Principles of using irrigation efficiency reports to determine the need for maintenance and repairs explained           |
| IAC0314 | Reasons for regular inspections and checks are explained                                                                |

# KM-07-KT01:

## Assets

### (34%, 0.68 credits)

## Topic Elements

The content of this chapter covers the following topic elements:

- KT0101: On-farm assets
- KT0102: Requirements for on-farm infrastructure, systems, tools, equipment and machinery used in fruit/grape production

### 1. KT0101: On-Farm Assets

#### IAC0101: On-farm assets are listed and defined

- Assets are defined as any item owned by the farm business that have value, including the items that the farm uses to produce the products they sell.
- Assets include tools, pieces of equipment, pieces of infrastructure, and property.
- Assets can be broadly divided into moveable and fixed assets.
- Fixed assets are long-term assets (usually property or infrastructure) that a farm owns and uses in production.
- Fixed assets are not expected to be consumed or converted into cash any sooner than at least one year's time and cannot be realistically moved.
- Moveable assets are short-term assets (usually equipment or infrastructure) that can be moved without causing material damage to the farm or its permanent structures.
- Moveable assets tend to have a much shorter life cycle than fixed assets.
- Assets are further classified by their:
  - Use or purpose.
  - Standard amount of the asset required.
  - When and how often the asset will be used.
  - The life cycle of the asset.
  - The cost of the asset, either as price per unit or total capital expenditure.
- Common moveable assets include:
  - Vehicles (trucks, tractors, quadbikes, etc.).
  - Manipulation tools and equipment (sprayers, applicators, shears, etc.).
  - Harvesting tools and equipment (clippers, bins, trailers, picking bags, etc.).
  - Construction equipment (bulldozers, backhoes, graders, etc.).
  - Workshop equipment (spanners, wrenches, drills, etc.).

- Office equipment (computers, printers, desks, etc.)
- Common fixed assets include:
  - Irrigation systems (pumps, filters, pipelines, etc.).
  - Water sources (reservoirs, tanks, boreholes, etc.).
  - Storage facilities (chemical storage, equipment storage, locker rooms, etc.).
  - Maintenance facilities (garages, workshops, etc.).
  - Logistics infrastructure (internal roads, parking, loading areas, etc.).
  - Security infrastructure (fencing, gates, security cameras, etc.).
  - Housing (worker accommodation, manager housing, etc.).
  - Worker health facilities (clinics, bathrooms, etc.).

### **IAC0102: The life cycle of an asset is described**

- The life cycle of an asset refers to the series of stages involved in the management of an asset.
- The life cycle starts with the initial identification of the need for the asset and ends with its eventual disposal or renewal.
- Every asset has five stages in its life cycle:
  1. Planning.
  2. Creation/Acquisition.
  3. Utilization.
  4. Maintenance.
  5. Renewal/Disposal.
- The first stage (planning) involves identifying the need for an asset, often performed when planning a new orchard or other operation.
- This planning is based on previous experience and industry recommendations.
- Planning also occurs when a current asset is reaching the end of its life cycle and must be replaced.
- Once the needed asset has been identified and all involved parties have agreed on the need for the asset, the next stage begins.
- The second stage (creation/acquisition) involves either making, purchasing, or otherwise getting the asset onto the farm.
- Depending on the asset, it can either be bought entirely (such as tools) or created on farm out of prebought material (such as constructing a fence).
- Many errors can be made during the second stage, including:
  - Acquiring or creating the wrong type of asset.
  - Acquiring or creating a low quality asset.
  - Acquiring or creating the asset too early or too late.
  - Improperly acquiring or creating the asset.
  - Acquiring or creating too much or too little of the asset.

- If an error occurs at this stage, it can affect all the other stages of the asset life cycle, sometimes only years later.
- The third stage (utilization) is when the asset is actually used.
- Often, the third stage (utilization) and fourth stage (maintenance) are combined in the asset's life cycle as they often occur at the same time, as assets are used and repaired continuously.
- These two stages are however separated as they involve different practices and often occur in smaller, repeating cycles.
- If all goes according to plan, utilization will be the longest phase of the assets' life cycle.
- The fourth stage (maintenance) involves all the work that will be done on the asset throughout its life cycle, including, but not limited to emergency repairs and scheduled maintenance.
- Maintenance must be performed regularly, by properly qualified individuals, using the right equipment, or the life cycle of the asset will be cut short.
- The final stage (renewal/disposal) involves replacing or renewing the asset when it is no longer fit for purpose.
- All assets will eventually have to be partially or fully renewed or replaced, but the length of time that this will occur in varies wildly between assets.
- Renewal and disposal ties into the first stage (planning) as the length of time the asset can be used for must be considered when selecting the asset.
- Asset renewal and disposal should be planned for, and farmers should not wait until the end of its life cycle to start looking for replacements and how to dispose of the asset.
- If an asset is vital for the proper functioning of the farm, management must ensure that replacement is planned and a proper method of disposal ready long before the asset reaches the end of its life cycle.
- Managing an assets life cycle involves using knowledge of the stages and the asset itself to extend the asset's usability as possible without losing any functionality.
- The most commonly neglected stages are proper management and initial setup or acquisition.
- Errors during the management of an asset can be caused by:
  - A lack of data.
  - Outdated policies.
  - A lack of care.
  - Human error.

### **IAC0103: Value of an asset to the farm is evaluated**

- Asset valuation is the process of determining the fair market or present value of assets.
- Asset valuation is performed by examining:
  - The purchase price or resale value of an asset.
  - The continued cost on maintenance of the asset.
  - The value the asset provides to the business.

- Some larger assets (such as orchards) are evaluated through evaluating all the various assets that make the larger asset up and combining their values.
- When evaluating assets, the following procedure is followed:
  1. Identify the specific asset to be valued.
  2. Assess the current physical condition and productive capacity of the asset to determine its remaining useful life.
  3. Collect market data to determine comparable sales or replacement costs for similar assets.
  4. Estimate the asset's ability to generate future income.
  5. Review operating costs associated with using or maintaining the asset.
  6. Compare future income and operating costs to calculate the asset's net contribution or cost to the farm.
  7. Select a suitable valuation method (market comparison, income capitalization, or cost approach) based on the asset type.
  8. Use the chosen valuation method to calculate a preliminary value.
  9. Factor external factors such as citrus market prices, weather risks, disease pressures, and regulatory constraints into the valuation.
  10. Factor depreciation or biological changes into the final estimate.
  11. Document the final asset valuation along with supporting data and assumptions in a recordkeeping system.

## self-assessment

### KT0101: On-Farm Assets

| Can I?                                                                | Y/N |
|-----------------------------------------------------------------------|-----|
| Can I define and classify assets?                                     |     |
| Can I list common moveable assets?                                    |     |
| Can I list common fixed assets?                                       |     |
| Can I differentiate between moveable assets and fixed assets?         |     |
| Can I describe the stages of an asset life cycle?                     |     |
| Can I determine the need for new assets?                              |     |
| Can I create or acquire new assets?                                   |     |
| Can I manage asset utilization?                                       |     |
| Can I manage asset maintenance?                                       |     |
| Can I renew or dispose of assets?                                     |     |
| Can I list common causes of errors during the management of an asset? |     |
| Can I evaluate assets?                                                |     |

## work scenario reference

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

| <b>IAC Code</b> | <b>IAC Title</b>                           | <b>Relevant Work Scenario(s)</b> |
|-----------------|--------------------------------------------|----------------------------------|
| IAC0101         | On-farm assets are listed and defined      | I1, I2, I3, I6, I7               |
| IAC0102         | The life cycle of an asset is described    | I1, I2, I3, I4, I7               |
| IAC0103         | Value of an asset to the farm is evaluated | A1, I1, I2, I7                   |

## **2. KT0102: Requirements for On-Farm Infrastructure, Systems, Tools, Equipment and Machinery Used in Fruit/Grape Production**

**IAC0104: Types of on-farm infrastructure, systems, tools, equipment and machinery used in fruit/grape production are described**

- In the context of citrus production, infrastructure refers to services and facilities that supports and enables production activities.
- The size of the farm or planned enterprise determines the type and extent of the infrastructure that will be necessary.
- Infrastructure includes both external (off-farm) infrastructure like national roads and shipping ports, and internal (on-farm) infrastructure.
- A large farm will need a large internal infrastructure to support the production process, and a smaller farm may not warrant large expenditure on internal infrastructure.
- On-farm infrastructure is planned along with the orchard or farm layout as part of the land utilisation plan.
- On-farm infrastructure includes:
  - Fencing.
  - Farm roads.
  - Irrigation infrastructure.
  - Energy infrastructure.
  - Farm buildings.
- Fencing serves to keep trespassers off the farm, mark the boundaries of the farm, and on farms with livestock, keep them from escaping.
- The most common types of fencing that erected on and around a farm are security fencing, cattle fencing, and small and large game fencing.
- The various types of fencing vary in construction and cost depending on purpose and location.
- Roads on farms include main roads, orchard roads, and smaller paths.
- Main roads should be positioned to serve all main production areas while limiting traffic in and around the orchards.
- Ideally, offices, the packhouse, stores and housing areas should be situated as nearly as possible to the farm entrance, so that movement in and around orchards is limited and only linked to production.
- Irrigation infrastructure should be, wherever possible, placed to minimise the distance water has to travel from water sources to orchards.
- Irrigation infrastructure includes:
  - Water storage (dams, tanks, reservoirs, etc.).
  - Pump-houses and pumps.
  - Pipes.
  - Filter systems.

- Emitters.
- Energy infrastructure serves to provide power for all production activities and should be carefully planned to enable possible future development of orchards and infrastructure.
- Electricity infrastructure includes:
  - Powerlines.
  - Transformers.
  - Generators.
  - Renewable energy sources (windmills, dams, solar panels).
- Farm buildings can include:
  - Storage facilities (chemical storage, equipment storage, locker rooms, etc.).
  - Maintenance facilities (garages, workshops, etc.).
  - Offices.
  - Housing (worker accommodation, manager housing, etc.).
  - Worker health facilities (clinics, bathrooms, etc.).
  - Laboratories and testing facilities.
  - Nurseries.
- The placement of the various buildings must be considered carefully when developing a new farm or part of a farm.
- All buildings should be situated so that they complement the farm activities, as well as assist with management and control.
- Farm buildings are normally grouped together for the sake of electricity supply, water supply, and access control.
- Noise factors must be accounted for, as buildings like offices should not be placed right next to the packhouse or maintenance shed.
- The extent of housing needed on a farm depends on the size of the farm as well as the distance to the nearest labour source or settlement.
- The number of houses that are required increases with the distance from a town or labour source, and special provision must be made for management, middle management and supervisory staff.
- Stores must be placed to ensure that access can be controlled to keep the equipment and stock items secure
- Stores must be easily accessible to authorised workers and managers and not excessively far from production areas.
- There are also special regulatory requirements with regard to the design and placement of agrochemical stores, and these requirements must be accounted when planning.
- Offices must be as close as possible to the main access road to the farm to limit on-farm traffic.
- The packhouse must be easily accessible from the orchards to limit traffic during harvesting.

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### **IAC0105: An inventory of tools, equipment and maintenance items is compiled**

- Compiling an inventory refers to creating a list of all the tools, equipment and maintenance items that the farm has in stock.
- When compiling an inventory, the following procedure is followed:
  1. Define the categories of items to be included in the inventory.
  2. Walk through all storage areas, workshops, and production areas to identify every item present.
  3. Inspect each item to judge its condition, functionality, and whether it is still in active use.
  4. Record the following information for each item:
    - Item name (if applicable).
    - Item description.
    - Serial number.
    - Item model.
    - Manufacturer.
    - Current condition.
    - Location of storage or use.
  5. Count the quantities of each item and verify the count against any existing lists or records.
  6. Note any missing, damaged, or obsolete items for replacement, repair, or disposal.
  7. Add digital photos or barcodes to records where applicable.
  8. Enter the collected information into a centralised inventory system or database.
  9. Review the final inventory list for accuracy and inconsistencies.

### **IAC0106: The basic principles of agricultural mechanisation are outlined**

- Mechanisation is the process of using machinery, tools, and technology to perform production tasks more efficiently and with reduced reliance on manual labour.
- Agricultural mechanisation involves selecting machinery and tools to perform work historically performed by workers.
- Mechanisation should only be implemented after it has been carefully calculated that the process will make the farm more profitable.
- This increased profit can come from more efficient production, reduced labour costs, or improve fruit quality.
- Selecting equipment for mechanisation involves researching new technologies and communicating with research bodies and other farmers.
- Mechanisation decisions are influenced by the farm's layout, size, complexity, and financial position.
- Mechanisation can improve efficiency through using less energy, fuel or other inputs, or performing practices faster or to a higher standard.

- Maintenance costs must be considered when planning mechanisation, since maintenance costs will usually increase significantly with increased mechanisation.
- Any new equipment or machinery must be carefully explained to workers, and additional training may be needed to ensure the new equipment or machinery is operated safely and effectively.
- Mechanisation considerations must include long-term sustainability and environmental impact.

### **IAC0107: The application of OSH act related to equipment and infrastructure is explained**

- The Occupational Health and Safety Act 85 of 1993 is a regulatory act that requires all employers to ensure that their workplace is safe for all workers.
- In farming, the OHSA aims to protect workers and other people on the farm from hazards to their health and safety while on the farm.
- The OHSA stipulates that all equipment and infrastructure on the farm must be designed, installed, and maintained in a way that prevents hazards to workers.
- Management on the farm is required to identify potential risks associated with equipment and infrastructure so that appropriate safety measures can be implemented.
- All mechanical tools and equipment must be fitted with proper safety equipment (such as guards, shields, and other safety equipment) to comply with OHSA.
- Infrastructure must be structurally sound and well maintained to eliminate risks such as collapses, slips, or electrical hazards.
- The OHSA requires that workers receive adequate training on the safe use and maintenance of all equipment used in citrus production.
- All equipment and infrastructure should have clear signage and labels displayed to warn workers of any hazards.
- All equipment and infrastructure should be regularly inspected to ensure that it remains in safe operating condition and complies with legal safety standards.
- Emergency procedures must be established and communicated to all workers.
- PPE must be provided to all workers when they operate machinery or enter areas where hazards are present.
- The farm management must keep records of training, maintenance, inspections, and incidents.
- Management must continuously review and update safety practices as new equipment is introduced or as regulations and risks change.

## self-assessment

### **KT0102: Requirements for On-Farm Infrastructure, Systems, Tools, Equipment and Machinery Used in Fruit/Grape Production**

| Can I?                                                           | Y/N |
|------------------------------------------------------------------|-----|
| Can I define infrastructure?                                     |     |
| Can I explain how infrastructure supports production activities? |     |

|                                                                                        |  |
|----------------------------------------------------------------------------------------|--|
| Can I determine the type and extent of infrastructure needed for a particular farm?    |  |
| Can I differentiate between external (off-farm) and internal (on-farm) infrastructure? |  |
| Can I list types of on-farm infrastructure?                                            |  |
| Can I list irrigation infrastructure?                                                  |  |
| Can I list electricity infrastructure?                                                 |  |
| Can I list farm buildings?                                                             |  |
| Can I properly place infrastructure when planning a new farm or expansion?             |  |
| Can I compile an inventory?                                                            |  |
| Can I manage and implement agricultural mechanisation?                                 |  |
| Can I train workers on the use of new machinery?                                       |  |
| Can I describe the requirements of the OHSA?                                           |  |
| Can I adhere to the OHSA?                                                              |  |

## 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  | Types of on-farm infrastructure, systems, tools, equipment and machinery used in fruit/grape production are described | A1, B1, I1, I2, I7        |
| IAC0105  | An inventory of tools, equipment and maintenance items is compiled                                                    | G2, I1, I6, I8, J2        |
| IAC0106  | The basic principles of agricultural mechanisation are outlined                                                       | A1, A2, A4, I2, I7        |
| IAC0107  | The application of OSH act related to equipment and infrastructure is explained                                       | A6, I2, K1, K2            |

# **KM-07-KT02:**

## **Use and Storage of On-Farm Infrastructure, Systems, Tools, Equipment and Machinery**

### **(33%, 0.66 credits)**

### **Topic Elements**

The content of this chapter covers the following topic elements:

- KT0201: Use of on-farm infrastructure, systems, tools, equipment and machinery
- KT0202: Storage of on-farm tools, equipment and machinery

#### **1. KT0201: Use of On-Farm Infrastructure, Systems, Tools, Equipment and Machinery**

##### **IAC0201: Fundamental principles of equipment use and abuse are listed**

- Equipment should only be used for its intended purpose according to the manufacturer's instructions and farm safety policies.
- Equipment abuse refers to any misuse, improper handling, or neglect of equipment that causes unnecessary wear, damage, safety risks, or reduced efficiency.
- All equipment must be properly checked before use to ensure it is in safe working condition.
- Maintenance and servicing must be carried out regularly and carefully to prevent avoidable breakdowns and to extend its useful work life.
- Equipment must be cleaned and stored correctly after use to protect it from damage and to prevent theft.
- Farm workers must handle equipment with care whenever transporting, storing, or operating them.
- Equipment should never be forced to operate beyond its limits, such as by overloading a trailer, as this can lead to increased safety risks and costly repairs.
- Unauthorised modifications, bypassing safety devices, or removing guards are prohibited because they compromise both the equipment and worker safety.
- Using low-quality or improper fuel, oil, or replacement parts reduces performance and may cause long-term damage.
- Operators should report defects, unusual noises, leaks, or performance issues immediately to prevent minor problems from escalating into major failures.

- Training and supervision are essential to ensure that workers understand the difference between responsible use and dangerous or damaging practices.

### **IAC0202: Methods of monitoring maintenance, sanitation and storage of tools and equipment are described**

- Monitoring the maintenance of tools and equipment involves keeping records of the condition of tools and equipment and the maintenance performed on them.
- Maintenance records include records of inspections, repairs, or servicing.
- Monitoring sanitation involves ensuring that all tools and equipment are being properly sanitised after use and in storage.
- Monitoring storage involves analysing storage records and inventories to ensure that tools and equipment are being properly stored.
- A maintenance logbook or digital database should be used to record performed maintenance for recordkeeping purposes.
- Detailed records of all inspections noting the condition of tools or equipment as well as the details of the inspection and inspector should also form part of these records.
- Sanitation practices are overseen through routine cleaning and sanitation checklists.
- Storage conditions are checked regularly to confirm that tools and equipment are kept in clean, dry, and secure locations that protect them from damage and theft.
- Inventory tracking systems are used to monitor which tools are in use, which are in storage, and which require repair or replacement.
- Colour-coding, labels, or barcodes are used to identify tools and equipment, making it easier to track their condition and location over time.
- Supervisors should conduct periodic audits of workshops and storage areas to ensure that all practices (including recordkeeping) are being properly performed.
- Staff must be trained to report any issues involving maintenance, sanitation, or storage immediately so that problems can be addressed before they affect production or safety.

### **IAC0203: Methods of monitoring the condition of infrastructure and determining the need for repairs or maintenance are discussed**

- To ensure that infrastructure remains safe and fit-for-purpose, all structures must be monitored on a regular basis.
- Monitoring ties into maintenance schedules, as monitoring informs the need for maintenance decisions.
- Infrastructure is most commonly monitored through regular visual inspections.
- Monitors must use standardised checklists to inspect infrastructure for wear, damage, or other issues, that should be noted and recorded in a database.
- Records must be checked by the maintenance team supervisor and analysed by the farm manager.
- Workers must also be trained to immediately report any condition issues they notice on infrastructure as monitors may not notice them in time.

## IAC0204: The importance of monitoring and maintenance of machines and equipment is explained

Refer to IAC0202: Methods of monitoring maintenance, sanitation and storage of tools and equipment are described.

## self-assessment

### KT0201: Use of On-Farm Infrastructure, Systems, Tools, Equipment and Machinery

| Can I?                                                          | Y/N |
|-----------------------------------------------------------------|-----|
| Can I ensure that equipment is operated safely and effectively? |     |
| Can I define equipment abuse and the risks associated with it?  |     |
| Can I describe the importance of regular maintenance?           |     |
| Can I properly clean and store equipment?                       |     |
| Can I monitor the maintenance of tools and equipment?           |     |
| Can I keep suitable records of tool and equipment maintenance?  |     |
| Can I monitor the sanitation of tools and equipment?            |     |
| Can I monitor the storage of tools and equipment?               |     |
| Can I create and maintain a maintenance logbook or database?    |     |
| Can I create sanitation checklists?                             |     |
| Can I perform audits of workshops and storage areas?            |     |
| Can I monitor the condition of infrastructure?                  |     |
| Can I utilise monitoring to schedule maintenance?               |     |

## 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  | Fundamental principles of equipment use and abuse are listed                                                            | A4, C2, F2, G3, K2        |
| IAC0202  | Methods of monitoring maintenance, sanitation and storage of tools and equipment are described                          | I1, I2, I3, I6, I8        |
| IAC0203  | Methods of monitoring the condition of infrastructure and determining the need for repairs or maintenance are discussed | I1, I2, I3, I4, I5        |
| IAC0204  | The importance of monitoring and maintenance of machines and equipment is explained                                     | I1, I2, I3, I4, I5        |

## 2. **KT0202: Storage of On-farm Tools, Equipment and Machinery**

### **IAC0205: Storage requirements for a range of on-farm tools, equipment and machinery**

- Tools and equipment can be expensive pieces of equipment, and storing them according to proper procedure is vital for ensuring they work effectively for many years.
- 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.

**IAC0207: The effect of poor storage activities on the serviceability of on-farm tools, equipment and machinery is analysed**

- Proper storage ensures that tools, equipment and machinery remain in good working condition, reducing the need for repairs and prolonging their useful life.
- Safe and organised storage minimises the risk of accidents, injuries, or other hazards, promoting a safer working environment for farm staff.
- Improper storage practices include leaving tools, equipment or machinery exposed to the weather, including rain or sun.
- These conditions can lead to rust, corrosion, and mould.
- Improperly stored machinery and equipment are more prone to mechanical failures and reduced operational efficiency.
- Cluttered or unorganised storage can damage tools and equipment or harm workers due to increased accidents.
- Improper storage of chemical equipment increases the risk of contamination, leaks, and fires hazards.
- Improper storage can lead to misplacement of tools and spare parts, causing delays to repair, increased costs, and disruption of production operations.
- Improper storage can also lead to more frequent repairs, increasing maintenance costs.

## self-assessment

**KT0202: Storage of On-farm Tools, Equipment and Machinery**

| Can I?                                                                             | Y/N |
|------------------------------------------------------------------------------------|-----|
| 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?                    |     |
| Can I explain the importance of proper storage of tools, equipment, and machinery? |     |
| Can I describe the risks of improper storage to tools, equipment and machinery?    |     |
| Can I describe the risks of improper storage to worker safety?                     |     |
| Can I describe the risks of improper storage to the environment?                   |     |

## work scenario reference

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

| <b>IAC Code</b> | <b>IAC Title</b>                                                                                                  | <b>Relevant Work Scenario(s)</b> |
|-----------------|-------------------------------------------------------------------------------------------------------------------|----------------------------------|
| IAC0205         | Storage requirements for a range of on-farm tools, equipment and machinery                                        | I1, I2, I3, I4, I8               |
| IAC0206         | The importance of compliance with sound storage requirements are justified                                        | I1, I6, I8, J1, J2               |
| IAC0207         | The effect of poor storage activities on the serviceability of on-farm tools, equipment and machinery is analysed | I1, I6, I8, J1, J2               |

# **KM-07-KT03:**

## **Maintenance of On-Farm Infrastructure, Systems, Tools, Equipment and Machinery (33%, 0.66 credits)**

### **Topic Elements**

The content of this chapter covers the following topic elements:

- KT0301: Maintenance principles
- KT0302: Maintenance of on-farm infrastructure and the systems, tools, equipment and machinery used in crop production
- KT0303: Condition of assets

#### **1. KT0301: Maintenance Principles**

**IAC0301: Principles of optimum efficiency of machines and equipment and the effect on the durability of the asset and production are described**

- Optimum efficiency refers to machines and equipment operating within their designed capacity, performing their tasks to a high standard without being overused or underused.
- Optimum efficiency can be ensured through regular maintenance and inspections, as well as ensuring that workers are well trained and operating the equipment safely.
- Machines and equipment may require adjustment for different seasons or jobs (such as calibrating a sprayer), and supervisors must ensure that all equipment is properly set for the task at hand.
- Optimum efficiency reduces fuel, water, and chemical consumption, which saves money and improves overall farm profitability.
- Operating at optimum efficiency also ensures that machines and equipment are not being overused or used improperly, which limits wear and tear and failures.
- This leads to less frequent need for maintenance, reducing maintenance costs.
- Downtime and work stoppage will also be limited due to less frequent breakdowns.

**IAC0302: The effect of wear and tear on the durability of the machines and equipment is analysed**

- Wear and tear refers to damage or depreciation from ordinary use of machines and equipment.
- Wear and tear gradually reduce the condition and performance of machines and equipment, shortening their overall lifespan if not managed properly.

- Wear and tear in citrus machinery and equipment is generally caused by:
  - Friction in moving parts.
  - Corrosion from chemicals or citric acid.
  - Misalignment.
  - Vibration.
  - Overloading.
  - Poor maintenance.
  - Rust from excessive humidity or moisture.
  - Foreign objects (stones, metal pieces).
  - Blunting (such as blades dulling from use).
  - Worker error and improper use.
- Exposure to environmental factors can accelerate wear and tear.
- Wear and tear can be mitigated through maintenance and proper storage.
- Ignoring wear and tear can lead to major mechanical failures.
- Wear and tear make production practices less effective and efficient, as equipment will be less efficient, less precise, and slower.
- Wear and tear must be monitored and noted during inspections to allow for timely intervention.
- Failure to manage wear and tear increases costs due to more frequent repairs, downtime, and reduced reliability.

### **IAC0303: Principles of scheduled maintenance are evaluated**

- Scheduled maintenance involves performing routine inspections, servicing, and repairs at predetermined times.
- Scheduled maintenance aims to address minor issues before they become large problems and cause breakdowns that may halt production entirely.
- Maintenance schedules are designed based on:
  - Manufacturers' recommendations.
  - Production practices.
  - Environmental conditions.
  - Cost.
  - Labour availability.
- Once maintenance schedules are created and implemented, they must be continuously evaluated to ensure that equipment is being sufficiently maintained and remaining in good condition.
- Scheduled maintenance reduces wear and tear, prolongs asset life, and improves the effectiveness of production practices.
- All maintenance activities must be documented and recorded in a logbook or database for future reference.

- Scheduled maintenance improves safety by ensuring that critical components of equipment are in good condition and do not fail during production, possibly harming workers.

#### **IAC0304: Breakdown of machinery and equipment and the effect of down time is analysed**

- Breakdowns occur when machines or equipment fail unexpectedly and are unable to perform their intended purpose.
- Breakdowns usually involve one or more components of a machine or piece of equipment failing.
- These components can be electronic, mechanical, or chemical.
- These component breakdowns occur for many reasons, including:
  - Wear and tear.
  - Poor maintenance.
  - Operator error.
  - Unexpected accidents.
- Breakdowns, especially during critical periods such as harvest, can cause significant delays and disrupt production schedules, costing farms a lot of money.
- Downtime reduces the efficiency of production practices, as workers may be forced to perform tasks manually, increasing labour costs and time.
- Frequent or prolonged breakdowns increase repair costs, as urgent fixes may require premium-priced parts, external technicians, or overtime labour.
- Downtime can negatively affect crop quality and yield, such as when harvesting is delayed.
- Repeated breakdowns also shorten the lifespan of machines and equipment, as emergency repairs often exacerbate wear and tear.
- Downtime can create a “ripple effect”, as one practice being delayed (such as chemical applications) delays another practice (such as harvesting, due to having to wait longer for chemical residues to dissipate).
- These “ripples” disrupt the overall workflow and efficiency of production.
- Monitoring breakdown patterns helps foremen identify recurring issues, allowing them to prevent breakdowns in future by adjusting maintenance schedules.
- All workers must be properly trained in how to prevent, address, and report breakdowns.
- Farm management should also have emergency plans in place for when breakdowns to occur, such as keeping spare parts or emergency suppliers and mechanics on call.

#### **IAC0305: Critical factors for working condition of infrastructure are outlined**

- Infrastructure is only effective when it is in good working condition.
- Good working condition refers to being stable, safe, and able to fulfil its purpose effectively and consistently.
- The factors that cause damage to infrastructure vary but are most commonly related to:
  - Environmental factors (such as tornadoes destroying buildings).

- Worker error (such as overloaded trucks weakening roads).
- Improper construction (such as low quality parts failing).
- Accidents (such as fires burning fencing).
- These factors can be mitigated through environmental management practices, worker training, and safety procedures.
- Regular maintenance and inspections also ensure that infrastructure remains in good working condition and any issues are caught and handled before they become serious problems that can halt production.

### **IAC0306: Principles of agricultural equipment maintenance are outlined**

Refer to IAC0303: Principles of scheduled maintenance are evaluated.

## self-assessment

### **KT0301: Maintenance Principles**

| Can I?                                                                                 | Y/N |
|----------------------------------------------------------------------------------------|-----|
| Can I explain the concept of optimum efficiency for machines and equipment?            |     |
| Can I describe the value of operating at optimum efficiency for farm profitability?    |     |
| Can I describe how maintenance, inspections, and worker training influence efficiency? |     |
| Can I adjust machines and equipment for different seasons or tasks?                    |     |
| Can I describe how optimum efficiency influences maintenance needs?                    |     |
| Can I define wear and tear?                                                            |     |
| Can I describe the long term negative effects of wear and tear?                        |     |
| Can I identify the causes of wear and tear in machinery and equipment?                 |     |
| Can I monitor and document wear and tear?                                              |     |
| Can I design and implement a maintenance schedule?                                     |     |
| Can I describe the negative effects of breakdowns?                                     |     |
| Can I list the reasons for component breakdowns in machinery and equipment?            |     |
| Can I explain the risks of equipment breakdowns during critical periods?               |     |
| Can I train workers to prevent, address, and report equipment breakdowns?              |     |
| Can I create emergency plans for breakdowns?                                           |     |
| Can I explain the importance of infrastructure being in good working condition?        |     |
| Can I identify the common factors that damage infrastructure?                          |     |

## 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  | Principles of optimum efficiency of machines and equipment and the effect on the durability of the asset and production are described | A4, I1, I3, I4, I5        |
| IAC0302  | The effect of wear and tear on the durability of the machines and equipment is analysed                                               | I1, I2, I3, I4, I5        |
| IAC0303  | Principles of scheduled maintenance are evaluated                                                                                     | I1, I2, I3, I4, I5        |
| IAC0304  | Breakdown of machinery and equipment and the effect of down time is analysed                                                          | I1, I2, I3, I4, I5        |
| IAC0305  | Critical factors for working condition of infrastructure are outlined                                                                 | I1, I2, I3, I4, I5        |
| IAC0306  | Principles of agricultural equipment maintenance are outlined                                                                         | I1, I2, I3, I4, I5        |

## **2. KT0302: Maintenance of On-Farm Infrastructure and the Systems, Tools, Equipment and Machinery Used in Crop Production**

### **IAC0307: The use of production plans to determine tools, equipment and machinery needs and maintenance requirements is explained**

- Production plans outline the schedule of all the activities involved in citrus production, including (but not limited to):
  - Irrigation.
  - Fertilisation.
  - IPM.
  - Manipulation.
  - Harvesting.
  - Packing.
- Production plans are used to determine labour, input, and asset needs.
- Assets here refer to equipment, tools, machinery, and vehicles.
- By reviewing production plans, managers can identify which assets are required for each activity and how much of each asset are needed, allowing them to order them well in advance.
- Production plans can also be used to estimate the need for maintenance and replacement of assets.
- Production plans also support inventory management by enabling managers to estimate the need for spare parts, consumables, and replacement tools needed for each stage of production.

### **IAC0308: Infrastructure maintenance plans are discussed**

- Infrastructure maintenance plans are detailed plans that list all the activities required to keep infrastructure in good working condition.
- These activities include:
  - Inspections.
  - Servicing.
  - Repair.
- The plans prioritise maintenance activities based on the criticality of the piece of infrastructure to production processes, safety, and regulatory compliance.
- Inspections are performed to detect early signs of damage, wear and tear, leaks, or other structural weaknesses that could compromise productivity or safety.
- Once issues are noted in inspections, preventive maintenance is scheduled to address these issues before they escalate into major problems.
- Maintenance plans also specify the resources required for infrastructure maintenance, including:
  - Labour.

- Tools and equipment.
  - Spare and replacement parts.
  - Cost.
- All maintenance activities listed in the maintenance plan must be documented and entered into a logbook or database.
- Maintenance plans are influenced by environmental factors, as unexpected events such as heavy rains may require increased maintenance.
- Maintenance plans must be regularly reviewed and updated to adapt to changes in infrastructure condition, farm expansion, or new regulatory requirements.

**IAC0309: Methods of monitoring maintenance, sanitation and storage of tools and equipment are described**

Refer to IAC0202: Methods of monitoring maintenance, sanitation and storage of tools and equipment are described.

## self-assessment

**KT0302: Maintenance of On-Farm Infrastructure and the Systems, Tools, Equipment and Machinery Used in Crop Production**

| Can I?                                                                 | Y/N |
|------------------------------------------------------------------------|-----|
| Can I describe the contents and purpose of production plans?           |     |
| Can I use production plans to determine labour, input and asset needs? |     |
| Can I use production plans to support inventory management?            |     |
| Can I create and interpret infrastructure maintenance plans?           |     |
| Can I describe the purpose of infrastructure inspections?              |     |
| Can I schedule preventive maintenance?                                 |     |
| Can I describe how environmental factors influence maintenance plans?  |     |
| Can I review and update maintenance plans?                             |     |

## 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) |
|----------|-------------------------------------------------------------------------------------------------------------------------|---------------------------|
| IAC0307  | The use of production plans to determine tools, equipment and machinery needs and maintenance requirements is explained | A2, G1, I3, I4, I8        |
| IAC0308  | Infrastructure maintenance plans are discussed                                                                          | I1, I2, I3, I4, I5        |
| IAC0309  | Methods of monitoring maintenance, sanitation and storage of tools and equipment are described                          | I1, I2, I3, I6, I8        |

### 3. KT0303: Condition of Assets

#### IAC0310: Critical factors for working condition of infrastructure are outlined

Refer to IAC0305: Critical factors for working condition of infrastructure are outlined.

#### IAC0311: Methods of monitoring the condition of infrastructure and determining the need for repairs or maintenance are evaluated

Refer to IAC0203: Methods of monitoring the condition of infrastructure and determining the need for repairs or maintenance are discussed.

#### IAC0312: Infrastructure maintenance plans are discussed

Refer to IAC0308: Infrastructure maintenance plans are discussed.

#### IAC0313: Principles of using irrigation efficiency reports to determine the need for maintenance and repairs explained

- Irrigation efficiency reports provide detailed information on water use, flow rates, and system performance, allowing foremen to identify areas requiring maintenance or repair.
- If a foreman notices inconsistencies in the irrigation, such as uneven flow, insufficient coverage, or slow delivery, this may be a sign that maintenance or repairs are required on the irrigation system.
- Irrigation efficiency reports should be regularly reviewed by the irrigation manager to detect issues early before they escalate into major problems that could disrupt irrigation entirely.
- Irrigation efficiency reports should also be used to plan maintenance activities, such as by scheduling maintenance before dry periods or high-demand irrigation cycles.
- Well-managed irrigation based on irrigation efficiency also ensures that irrigation components such as pumps, valves, and emitters are operating at peak efficiency.
- This peak efficiency limits maintenance and repair costs, water waste, and energy costs, all of which save the farm money.
- Irrigation reports can also inform decisions to replace or upgrade irrigation components or systems, which will limit long-term maintenance costs through increased efficiency.

#### IAC0314: Reasons for regular inspections and checks are explained

Refer to IAC0202: Methods of monitoring maintenance, sanitation and storage of tools and equipment are described.

## self-assessment

### KT0303: Condition of Assets

| Can I?                                                                   | Y/N |
|--------------------------------------------------------------------------|-----|
| Can I describe the content and purpose of irrigation efficiency reports? |     |
| Can I use irrigation efficiency reports to schedule maintenance?         |     |

|                                                                                                          |  |
|----------------------------------------------------------------------------------------------------------|--|
| Can I regularly review irrigation efficiency reports to detect issues?                                   |  |
| Can I explain the value of high irrigation efficiency?                                                   |  |
| Can I use irrigation efficiency reports to inform decisions to replace or upgrade irrigation components? |  |

## 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) |
|----------|-------------------------------------------------------------------------------------------------------------------------|---------------------------|
| IAC0310  | Critical factors for working condition of infrastructure are outlined                                                   | I1, I2, I3, I4, I5        |
| IAC0311  | Methods of monitoring the condition of infrastructure and determining the need for repairs or maintenance are evaluated | I1, I2, I3, I4, I5        |
| IAC0312  | Infrastructure maintenance plans are discussed                                                                          | I1, I2, I3, I4, I5        |
| IAC0313  | Principles of using irrigation efficiency reports to determine the need for maintenance and repairs explained           | A3, A4, B4, I3, I4        |
| IAC0314  | Reasons for regular inspections and checks are explained                                                                | I1, I2, I3, I6, I8        |