NQF Level: 3 **US No: 116265**

Learner Guide

Primary Agriculture

Pests, diseases and weeds

My name: . . . . . .

Company: . . . . . .

Commodity: . . . . . Date: . . . . . .

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Department:
Agriculture
REPUBLIC OF SOUTH AFRICA

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Before we start...

Dear Learner - This Learner Guide contains all the information to acquire all the knowledge and skills leading to the unit standard:

Title:	Monitor pests, diseases and weeds on crops			
US No:	**116265**	**NQF Level:** 3	**Credits:** 2	

The full unit standard will be handed to you by your facilitator. Please read the unit standard at your own time. Whilst reading the unit standard, make a note of your questions and aspects that you do not understand, and discuss it with your facilitator.

This unit standard is one of the building blocks in the qualifications listed below. Please mark the qualification you are currently doing:

Title	ID Number	NQF Level	Credits	Mark
National Certificate in Animal Production	49048	3	120	❒
National Certificate in Plant Production	49052	3	120	❒

Please mark the learning program you are enrolled in:

Your facilitator should explain the above concepts to you.

Are you enrolled in a:	Y	N
Learnership?	❒	❒
Skills Program?	❒	❒
Short Course?	❒	❒

This Learner Guide contains all the information, and more, as well as the activities that you will be expected to do during the course of your study. Please keep the activities that you have completed and include it in your **Portfolio of Evidence**. Your PoE will be required during your final assessment.

What is assessment all about?

You will be assessed during the course of your study. This is called *formative assessment*. You will also be assessed on completion of this unit standard. This is called *summative assessment*. Before your assessment, your assessor will discuss the unit standard with you.

Assessment takes place at different intervals of the learning process and includes various activities. Some activities will be done before the commencement of the program whilst others will be done during programme delivery and other after completion of the program.

The assessment experience should be user friendly, transparent and fair. Should you feel that you have been treated unfairly, you have the right to appeal. Please ask your facilitator about the appeals process and make your own notes.

Your activities must be handed in from time to time on request of the facilitator for the following purposes:

- The activities that follow are designed to help you gain the skills, knowledge and attitudes that you need in order to become competent in this learning module.
- It is important that you complete all the activities, as directed in the learner guide and at the time indicated by the facilitator.
- It is important that you ask questions and participate as much as possible in order to play an active roll in reaching competence.
- When you have completed all the activities hand this in to the assessor who will mark it and guide you in areas where additional learning might be required.
- You should not move on to the next step in the assessment process until this step is completed, marked and you have received feedback from the assessor.
- Sources of information to complete these activities should be identified by your facilitator.
- **Please note** that all completed activities, tasks and other items on which you were assessed must be kept in good order as it becomes part of your **Portfolio of Evidence** for final assessment.

Enjoy this learning experience!

How to use this guide ...

Throughout this guide, you will come across certain re-occurring "boxes". These boxes each represent a certain aspect of the learning process, containing information, which would help you with the identification and understanding of these aspects. The following is a list of these boxes and what they represent:

What does it mean? Each learning field is characterized by unique terms and **definitions** – it is important to know and use these terms and definitions correctly. These terms and definitions are highlighted throughout the guide in this manner.

You will be requested to complete **activities**, which could be group activities, or individual activities. Please remember to complete the activities, as the facilitator will assess it and these will become part of your portfolio of evidence. Activities, whether group or individual activities, will be described in this box.

Examples of certain concepts or principles to help you contextualise them easier, will be shown in this box.

The following box indicates a **summary** of concepts that we have covered, and offers you an opportunity to ask questions to your facilitator if you are still feeling unsure of the concepts listed.

My Notes ...

You can use this box to jot down questions you might have, words that you do not understand, instructions given by the facilitator or explanations given by the facilitator or any other remarks that will help you to understand the work better.

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What are we going to learn?

What will I be able to do?

When you have achieved this unit standard, you will be able to:

- A learner achieving this standard will be able to recognize, monitor and apply basic control of insects, plant diseases and common weeds, in a specific agricultural enterprise. In addition they will be able to report their findings to management or advisors.
- Learners will gain an understanding of sustainable agricultural practices as applied in the animal-, plant and mixed farming sub fields. This unit standard focuses on the application of pest control practices in primary agriculture.
- They will be able to participate in, undertake and plan farming practices with knowledge of their environment. This unit standard will instill a culture of maintenance and care for both the environment as well as towards farming infrastructure and operations.

Learning Outcomes

At the end of this learning module, you must is able to demonstrate a basic knowledge and understanding of:

- The person is able to demonstrate a basic knowledge of:
- Insect anatomy.
- Common plant diseases.
- Common pests.
- Common predators.
- Common beneficial insects.
- Common diseases.
- Life cycle of an insect.
- Natural enemies.
- Ways of spreading.
- Contamination.
- Implication of contamination on the quality and marketability of the product.
- Importance of hygiene.
- Scouting procedures.
- Record keeping.
- Hygiene.
- Spreading of pests and diseases.

What do I need to know?

It is expected of the learner attempting this unit standard to demonstrate competence against the unit standard:

It is assumed that a learner attempting this unit standard will show competence against the following unit standards or equivalent:

- NQF 3: Demonstrate a basic understanding of the physiological functioning of the anatomical structures of the plant.
- NQF 2: Control pests and diseases ad weeds on crops effectively and responsibly.

My Notes ...

Session 1 Monitor for common crop pests

After completing this session, you should be able to:
SO 1: Monitor the common pests prevalent in the specific agricultural enterprise.

In this session we explore the following concepts:

- Identification of common Insects in crop production
- Insect Development
- Insect Feeding
- Crop Damage Caused By Insects
- Insect Pest Status
- Identification of crop Pests
- Beneficial Insects

1.1 Identification of common insects in crop production

What are insects

Animals are widely classified in to two main groups, those with and the skeleton on the inside and those with the skeleton on the outside. Insects are classified in the group of animals known as Arthropoda or the animals with an exoskeleton (skeleton on the outside). There are approximately one million known insect species in the world. In Southern Africa approximately 80 000 species of insects have been identified. Insects are generally viewed as pests, but the majority of insects many insects are invaluable for the existences and activities of man, whilst only a small proportion of insects conflict with man in the production of food and industrial crops. The pest insects do however cause huge losses annually to agricultural crops, either whilst still on the field, or during post harvest storage.

What do Insects look like?

- Insects are distinguished from other animals by the following morphological characteristics:
  - Insects have an exoskeleton i.e. the skeleton is on the outside of the body
  - The body is divided into three distinct parts, a head, thorax and abdomen

- The head usually carries one pair of antennae and mouth-parts
- They have six legs, attached to the thorax
- Winged species normally have one or two pairs of wings also attached to the thorax

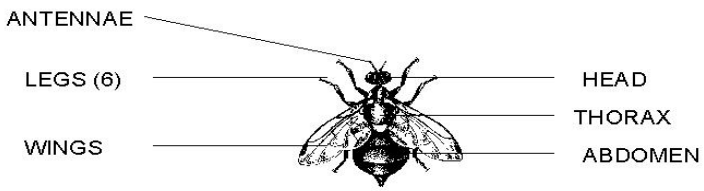


Figure 1.1. Diagram of an insect showing morphological features

The abdomen in usually divided into 11 segments and carries appendages required in reproduction. Insects generally hatch from eggs that had been laid The exoskeleton is a rigid structure that does not allow for much expansion. For growth the insect sheds the exoskeleton, replacing it with a larger one during the insects development.

1.2 Insect development

The process in which the insect "loses its skin", replacing it with a new one in known as moulting. The development stages after moulting are known as instars. In most insects the instars that develop are not alike look different. The change in morphology of instars within single species is known as metamorphosis. Insect are divided into two groups, those with incomplete or complete metamorphosis.

♦ Insects where metamorphosis is simple – incomplete metamorphosis:

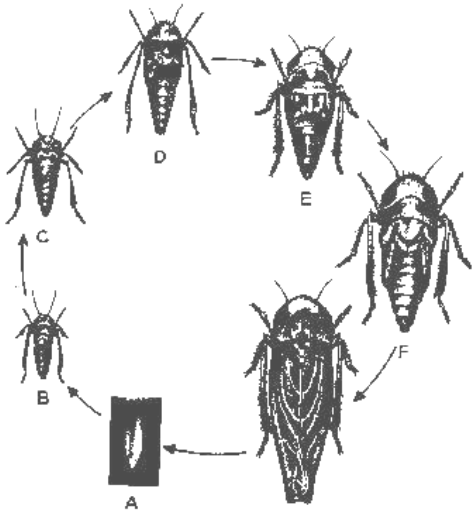


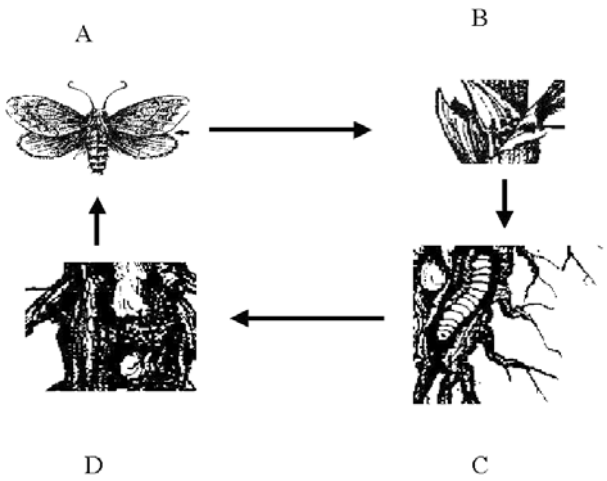
Figure 1.2. Diagram illustrating incomplete metamorphosis as found in the Leafhopper. A: egg, B – F First to Fifth instars, G: Adult.

- The process of incomplete metamorphosis is set out below:

The insect hatches from the egg as larvae called nymphs. The larvae and the adult insects are similar in appearance. There are no pupae. The larvae and adults live in the same habitat and the use the same food source. Examples of these types of insects are locusts and cockroaches.

- Insects with more complex metamorphosis – complete metamorphosis.

Figure 1.3. Diagram illustrating complete metamorphosis as found in the maize stalk borer. A: adult, B: eggs, C: larvae (caterpillar) D: pupae.



The larvae and the adults are different in appearance and so also the habitat and food sources are different. The insects hatch as worm-like larvae. The larvae go through a number of larval moults, and then go into a pupae phase. Pupae are normally covered in protective material. The final development stage from the pupae is the adult. Examples of this type are moths and flies.

1.3 Insect feeding

Insects can further be divided into groups according to their feeding habits, similar to the classification in other animals. The groups of plant feeders, predators, scavengers and parasites can be distinguished. In this section we will concentrate on insects that use plants as food source.

On the basis of the plants that insects feed on insects can be further divided on the basis of the plants they feed on. Insects that feed on a single plant species are known as monophagous insects, those that feed on related species are **oligophagous**, and those that feed on a variety of plants are polyphagous insects.

Furthermore insect are classified as those with **biting-chewing mouth parts** and those with **sucking mouth parts**. Insects with biting-chewing mouth **parts** include caterpillars of moths and beetles, leaf miners, stem borers and stalk borers.

Those with sucking mouth parts suck the plant sap from plant tissues. The best known of this type of insects is probably aphids.

1.4 Crop damage caused by insects

Insects damage to crop plants leads to crop damage and crop losses. Crop damage is classed in three groups.

Direct damage – is the damage caused to the marketable crop product, directly by the insect. This class of damage is found predominantly with biting-chewing insects an example of which is fruit fly damage to fruit.

Indirect damage occurs to a marketable product which occurs as a secondary effect of insect feeding. This occurs especially due to insects with sucking feeding habit. An example of this type of damage is aphids sucking on plant sap decreasing crop yields potential.

Cosmetic damage occurs where the insect damage is caused to the marketable product, but the damage is of a cosmetic nature, and thus a consumer issue. An example is that of citrus scale damage where the citrus is marketable but the product is of lower fiscal value.

1.5 Insect pest status

Insect pests have a short life cycle, which periodically benefits from favourable environmental conditions. Pest control is generally only a short-term suppression of the pest population. The control strategy selected is based on economic principals.

The economic benefit of pest control can be calculated only if the cost of control actions, as well as the effects of the pest on the crop yield are known and these costs to not exceed the yield benefit. We need to know the control methods, as well as the costs for each, and the cost implication of the pest if no control action is launched. Once all the factors are known, then the economic benefit of the control action and the correct timing thereof can be calculated. Pest control should only be applied if economically justified.

The factors that should be considered are:

- Control costs
- Potential damage of the pest on the crop
- The stage at which the control action should be taken
- Is the control action aimed at the correct stage
- Is the potential loss more than the cost of control

The decision of pest control is not always based on a balance of costs, but sometimes on the potential cosmetic implications of not controlling a pest, such as in the case of parks and grounds.

1.6 Identification of crop pests

Often we cannot see the insect but we do observe damage to the foliage or other parts of the crop plant. What follows is a rough guide that links the symptoms to the potential cause.

Examples of some symptoms and causal agents are given below:

When the symptom of yellowing (chlorosis) is there the symptom position should be examined.
Yellowing of Foliage with additional curling of leaves, the presence of honeydew and a sooty mould present is usually due to aphids (asmall, green to almost black insects; with spindly legs).
If the foliage is Chlorotic, leaves curled; and a fine webbing is present this is likely due to spider mite (a very small, reddish, 8-legged mite).
If yellowing is in spots, turning brown and dying of leaves it is likely caused by stinkbugs (greenish, or black and orange or greyish, shield-shaped or elongate, smelly insects).
Where the symptoms observed are primarily holes developing in leaves:
Small holes in leaves, giving them a peppered appearance is caused by flea beetles (small, oval, dark-coloured active beetles).
Round holes in leaves and or serrated edges is caused by snout beetles (greyish or greyish brown beetles with snouts, active at night)
Irregular holes in leaves, associated with slime trails is caused by snails and slugs.
Foliage partially eaten caused by bollworm (green to brownish caterpillars with broad, whitish, lateral stripe)
Sweet-potato foliage partially eaten caused by sweet potato hawk moth (large, green to brown, streaky caterpillars, with horn on last segment)
Leaves folded by silk threads caused by painted lady caterpillars (spiny, black caterpillars feeding on leaf surface)
Fine tunnels in sweet-potato foliage caused by sweet potato leaf miner (small, whitish caterpillars)

Where primary symptoms are damage to roots and lower stem

Young stems severed cleanly at ground level; plants wilt and die caused by cutworms (light to dark grey caterpillars active at night, hiding shallowly in soil by day)
Holes eaten in stems and sprouts below ground; plants stunted or wilt and die may be caused by black maize beetle, spotted maize beetle, wireworms and /or false wireworms.
Green larvae, slug-like but not slimy, and grey brown beetles feeding only just above ground are caused by vegetable snout beetle
Tunnels on lower stem, roots and tubers of sweet potato filled with excrement; infestation continued in storage caused by sweet potato weevils (whitish grubs and dark-coloured, antlike beetles with elongated snouts)
Tunnels in asparagus sprouts or mushroom stems below or above ground may be caused by bean seed maggot, asparagus fly or mushroom flies.
Plants stunted, crop poor; knots or lesions on roots, sweet-potato tubers crack may be caused by nematodes.
Carrots scarred; roots riddled with rust red burrows may be caused by carrot rust fly.

In all cases where damage to your crop is expected, speak to an extension officer, pest control expert or representative from pest control or seed and seedling companies for advice or the correct product to use.

1.7 Beneficial insects

Not all insects are problem insects. Some insects are beneficial to the farmer because they help to control the problem insects. Beneficial insects fall into a variety of categories, two of which are predators and parasites. Predators hunt and feed on pests, while parasites hatch inside or on a pest, and then they eat the pest as they grow. Other beneficial insects such as bees are useful in providing pollination such as found in tree crops.

First, we need to be able to recognize the difference between pests and beneficial insects. Then try to minimize insecticide applications, because many insecticides will kill the beneficial as well as the pests. We need to use selective insecticides that target a particular pest and use spot-treatment if possible.

Maintain the habitat of beneficial insects by leaving crop residue on the ground and preserving woodlots, windbreaks, fencerows, and un-mowed grassy ditch banks and waterways. Finally, provide pollen, nectar sources, or artificial food.

Harmful insects attack or damage plants or eat the crop. Harmful insects are also vectors that spread disease. Harmful insects can be controlled by introducing or maintaining beneficial insects in the fields or orchards.

What follows are examples of beneficial insects:

Bees
You can encourage these diligent little plant pollinators to your garden by planting the flowering shrubs and herbs they love - lavender, lemon balm, marjoram, hyssop, basil, coriander, thyme, borage and mint.

Beetles
Just as bees should be encourage to call your field or orchard home, it is important not to see every beetle as an enemy. Many are beneficial predators and feed on slugs, snails, caterpillars, cutworm, moth larvae and small insect pests, even if they do chew the odd leaf of a prized rose bush as well.

Butterflies
Although their hatched eggs - as caterpillars - will damage crops, butterflies themselves do little harm and help to pollinate many flowers. As with many aspects of companion planting, this is one area where the aspiring organic garden may have to tolerate a less-than-perfect compromise.

Centipedes
Very useful. They eat caterpillars, slugs and other pests and help break down decaying garden waste.

Earthworm
Most important to the success of agriculture planned along organic principles. They virtually create the topsoil by depositing their mineral-rich castings back into the earth.

Earwig
They look like small beetles, the main difference being the pair of pincers they have at the end of their body. On the positive side they eat small insects and their larvae, particularly codling moth. On the negative side, they can also make quite a mess of your plants.

Hoverflies
Don't see these odd, wasp-shaped little insects as enemies. They are to be cherished as natural predators, and significantly contribute towards the maintenance of a healthy garden. They prey on scale insects, mealy bugs and mites. Their larvae eat aphids, codling moth larvae, caterpillars and slugs.

Lacewings
Nature is often quite deceptive. The aptly named lacewing, with its beautiful, gauzy, iridescent wings and huge golden eyes is actually one of the garden's most efficient assassins. In a single season, the larvae of just one female lacewing - called 'aphid lions' or 'ant lions' because of their voracious appetite - can eat over 13 million aphids in a most savage fashion.

Ladybirds
A most useful insect to have in the garden having a prodigious appetite for aphids, thrips and the larvae of many leaf-eating insects. A single adult ladybird can devour up to 400 aphids a day.

Praying Mantises
A ferocious killer. Both the mantises and their larvae will kill and eat most beetles, bugs, wasps, spiders, flies and caterpillars, helping to keep these pests at tolerable levels. Unfortunately, they will also eat beneficial insects, like bees and other predatory wasps.

Spiders
Spiders come in an enormous variety of shapes and sizes and, to the uninitiated gardener, they can all be seen as pests. However, spider are extremely useful creatures. Natural predators, they feed upon many insects which are a nuisance.

Wasps
Wasps need protein-rich food for their young and so often help the gardener by eating small insect pests like slugs, codling moth larvae, thrips, stink bugs, weevils, grubs, caterpillars and scale insects.

My Notes ...

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Please complete Activity **1:**

Investigate and Report

At your place of work determine the following and write a concise report providing details:

1. What are the most important pests of the crops that are grown at your place of work?
2. Describe the damage caused by these pests.
3. What integrated pest management techniques are used on the farm to combat these pests?
4. If IPM is practised, how are pest predators encouraged on farm (if any).
5. How do you ensure that these populations are kept intact at your place of work?

Concept (SO 1)	I understand this concept	Questions that I still would like to ask
The pest monitoring process for the specific agricultural enterprise is explained.		
The significance for the monitoring of pests is explained.		
The differences between pests and predators are explained.		
The relationship between pests and predators with relation to control measures is explained.		
The ability to observe, categorize and report any new plant damage is demonstrated.		
The importance of the recording of data is explained.		

My Notes ...

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Session 2 Monitoring crop fields for pests, diseases and weeds

After completing this session, you should be able to:

SO 1: Monitor the common pests prevalent in the specific agricultural enterprise.

SO 2: Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases and weeds.

SO 3: Collect insects not familiar and that had been identified.

In this session we explore the following concepts:

- Why pests should be monitored
- Scouting for crop pests, diseases and weeds.
- Sampling insects
- Record keeping

2.1 Why pests should be monitored

In order to prevent crop damage from insects and diseases it is essential that crops be inspected regularly. These inspections should be done regularly and could be done in conjunction with inspections for weed densities and crop nutrient and water status.

Crop monitoring indicates the pest status and extent of the crop diseased. In this way the crop producer remains informed of the health status of his crop. Information on the crop disease and pest status enables the farmer to make decisions on whether control actions need to be taken, and select a suitable control action. In this way the farmer can e.g. chemically treat crops as and when required instead of according to a strict spraying programme. In this way the amount of pesticide applied and labour inputs can be reduced, reducing the crop production costs.

2.2 Scouting for crop pests, diseases and weeds

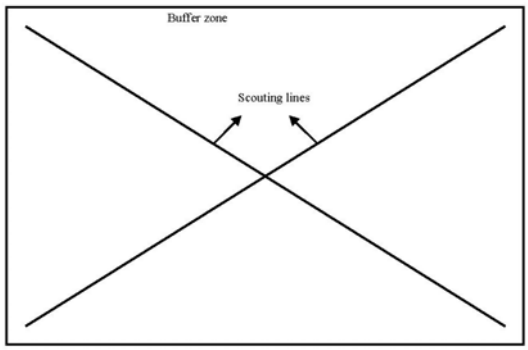
The monitoring process is generally known as scouting. Scouting is used to identify pest species present as well as the extent of infestation of the pest. This can also be applied to crop diseases. In the case of crop disease it is not always possible to identify or see the causal agent of disease. Thus when monitoring for crop disease the scouting process is aimed at identifying symptoms of disease, rather than collecting, identifying and counting individual pests. Plant samples can be collected for identification by experts.

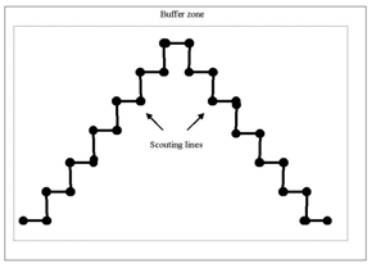
Pest control programmes are based on infestation thresholds as well as economic thresholds for pest control. The programmes take into account the growth stages of the crop plant and relate this to pest infestation rates. This aids in evaluating the vulnerability of the crop and the potential for damage that exists. The occurrence of natural pest enemies and pathogens must also be taken into account in the monitoring process.

The monitoring process starts with surveys. Monitoring techniques exist to aid in crop survey. The two most useful survey techniques are the transect and step-wise method scouting or placement of traps. Both techniques require the investigator to walk through a field, then stopping and sampling or scouting or counting at pre determined, set intervals. Where scouting is done for diseases the monitor should collect leaf, shoot, bud and fruit samples for identification by experts. Where the presence of diseases is suspected samples must be collected and sent for analysis and identification by an expert.

The transect scouting method involves scouting along a line across a field. The line can be diagonally across the field or parallel to the side of the field.

When using the transect scouting method a minimum of five sampling points per hectare should be selected.





When using the **stepwise scouting** method the scout starts in the middle of one side of the field.

The scout moves **forward** and to his right stopping at pre determined distances. Once he has crossed the whole field, the scout moves to the point of origin and repeats the exercise, but now moving forward and to his left. A maximum distance 5 m should be used as pre set distance.

Once samples of insects or diseased plant parts have been collected the insects and diseases are identified. Counts of the number of pests are done to determine infestation rates. Based on the identity of the pest and degree of infestations, crop information and environmental information a management strategy can be implemented.

At the pre-determined intervals using either of the scouting methods, sampling techniques for insect collection can be used. Sampling techniques generally used in pest monitoring are set out below:

- **Shake and beat method:** involves placing plastic sheeting under the crops then shaking the plants or beating them with a sick and insect which fall on the sheeting are then collected.
- **Knock- down sampling:** an insecticide is applied to a small area within the target area, which kills all insects present. Similarly to the shake and beat method, insects are collected on a pre-set plastic sheet.
- **Baits containing insecticides:** can be used to attract and sample insects. Insecticide laced molasses is an example
- **Mites can be sampled** by brushing the crop leaves onto a glass sheet. Alternatively the mites can be brushed onto paper, the paper flattened and the stains on the paper counted.
- **Sweep nets** are used to sample for flying insects such as leaf-miners. The net made from suitable material is swept across the plants and insects so collected.
- **Malaise traps** are used for active insects and consists of an open ended tent like net with one end open. A container for trapping the insects is placed at the highest end.

- **Sticky traps** are made from suitable surface cover in sticky surface. The sticky trap can be baited to attract certain species. The trapping efficacy of these type of traps are influenced by environmental conditions and the positioning of the trap.
- **Water traps** are suitable containers containing water to which a soapy substance and a preservative is added erected 1 m above soil level. The traps are suitable especially for trapping aphids.
- **Sucking traps** are basically modified vacuum apparatus, which sucks the insects into a net.
- **A light trap** is a lamp, usually ultraviolet, surrounded by a vertical baffle at the top of a funnel–shaped container, and a sampling container at the bottom.
- **Pheromone traps** are used for moths and butterflies. Pheromones (sexual hormones) of the target species is placed in a suitable container. The traps are set up over a large area and are suitable for monitoring of populations and also for pesticide application timing.
- **Pit fall traps** are containers with a small volume of preservative which are placed into the soil so that the open end is level with the soil surface. These traps are effective for insects that live on the soil surface.
- **Soil sampling** for soil dwelling insects can be done by using and auger soil coring device or a blade sampler. It is important that the volume of soil is known, so that the infestation per volume can be calculated.

2.3 Sampling insects

Insects can be found almost everywhere which means one should look for them everywhere. Look both underneath and n the upper leaf surfaces. Look inside flowers and on stems and branches. Make sure you check all the different size and positions of branches. In some crops, the fruit must be removed and cut in order to find the pest. In other cases you will be monitoring for symptoms of the presence of the pest, and not necessarily the pest itself. If you are collecting unknown insects for identification purposes you should try to collect the insects in as a perfect condition as possible. Also try to collect the larval stages, or what you might think is the larval stage of the pest. Once you have found the insect, it is placed in a kill-jar. A kill-jar is a bottle (usually glass) with a tight fitting lid. The bottom 2 cm or so of the jar should contain an adsorbent material such as plaster of Paris which has set. The plaster of Paris is then drenched with a suitable solvent, which will kill the insect. Ensure that a wet layer of solvent is not formed n the surface as the wet solvent may damage the insect. Once the insect is dead, it can be t transferred to a holding jar or sample jar, labelled and sent for identification.

- Insect that have been caught in traps are like to be dead already, and these can be placed directly into a collection jar. Keep records of all the information you deem relevant during collection.

2.4 Record keeping

During monitoring, all data collected must be recorded. It is important to know the density of occurrence of pests, diseases and weeds. Also one has to know where these occur and when these were first observed. All data must be written down and kept not only for a particular season, but if kept over a number of years, trends and timing of various problems can be traced. Not only should you keep record of the problem, but also of the treatments and interventions made to control the problem. This allows one to track what has been tried and how successful these have been. The table below is an example of a data sheet that can be used to collect monitoring and treatment data.

Scouting Data Sheet	
Farm Name:	Weed Density / No of insects / % infection
Monitor Name:	Replicate 1
Date: Time:	Replicate 2
Crop:	Replicate 3
Pest Type: (weed/Insect/disease)	Replicate 4
Field no:	Replicate 5
Position:	Replicate 6
Monitoring Method:	Replicate 7
Pest identification:	Replicate 8
Trap type used:	Replicate 9
Sample Collected Y/N	Replicate 10
Sample Number:	Average:
Pest Control Information:	
Method used:	Application Volume:
Pesticide Used:	Concentration Applied:
Active ingredient:	No of Applications:
Application Type:	Weather Information:

Please complete Activity **2.**

Investigate and Report

At your place of work determine the following and write a concise report providing details:

1. What traps are used for monitoring pet populations at your place of work?
2. What data is collected?
3. How is the data interpreted?
4. Describe the use of monitoring techniques other than taps used on farm
5. Collect and describe the procedures used for pests, weeds and diseases monitoring at your place of work
6. What data are recorded, where and for how long are these records stored.
7. Describe how the principals of economic thresholds for pest, weed and disease control are applied at your place of work.

Please complete Activity 3**.**

Investigate and Report

At your place of work determine the following and write a concise report providing details:

1. Describe and demonstrate the insect collection techniques used at your place of work
2. How are unknown pest identified?
3. Why are these identified?
4. Where are the samples sent for identification?

Concept (SO 1)	I understand this concept	Questions that I still would like to ask
The pest monitoring process for the specific agricultural enterprise is explained.		
The significance for the monitoring of pests is explained.		
The differences between pests and predators are explained.		
The relationship between pests and predators with relation to control measures is explained.		
The ability to observe, categorize and report any new plant damage is demonstrated.		
The importance of the recording of data is explained.		

Concept (SO 2)	I understand this concept	Questions that I still would like to ask
The different types of traps that can be used in pest monitoring is explained.		
The significance of these traps and how they are assessed is explained.		
The techniques of monitoring pests when traps are not used are explained.		
The monitoring of diseases and weeds is explained.		
Different methods of recording the data are explained.		
The use of data to control pests is explained.		

Concept (SO 3)	I understand this concept	Questions that I still would like to ask
The need to trap, collect and send unknown pests for identification especially when occurring in large numbers is explained.		
The way in which these pests will be collected and where they could be sent for identification is described.		
The reasons for identifying pests are explained.		

My Notes ...

Session 3 Crop diseases

After completing this session, you should be able to:
SO 4: Monitor the symptoms of disease associated with the agricultural enterprise.

In this session we explore the following concepts:

- Diseases of crops
- Fungal Diseases
- Bacterial Diseases
- Plant Viruses
- Control of Plant Diseases
- Chemical Control of Fungal Diseases
- Identification of unknown diseases farm

3.1 Diseases of crops

A plant disease is a disturbance brought about by a factor, which interferes with the manufacture, transport and utilisation of energy sources or mineral nutrients and water in such a way that, plant growth is negatively affected. Plant diseases are caused by pathogens and environmental factors. A plant pathogen is an organism which grows on a plant which provides growth factors. These organisms are generally not capable of producing their own food sources. The pathogenic organisms that cause disease are **funguses, bacteria, mycoplasms, viruses** and **nematodes**. Environmental factors which can cause plant diseases include temperature extremes, soil moisture extremes, light extremes, lack of oxygen, pollutants and nutrient stress. This section deals with the pathogenic origins of plant diseases.

3.2 Fungal diseases

Fungal diseases are caused by Fungi. Fungi are plants that do not contain chlorophyll and thus they are not green and cannot convert sunlight energy to chemical energy. Fungi cannot produce its own carbohydrates. The vegetative parts of fungi consist of thin **filaments** known as **hyphae**, which masses together form a body or a mass known as a **mycelium**.

Figure 4.1 Diagrammatic representation of the fungal filaments, known as hyphae (left) and a hyphal mass known as mycelium (right)

Fungi reproduce vegetatively through the filamentous hyphae and sexually through spores. Fungi as a group is divided into two sub-groups groups, the slime moulds (lower fungi) and the true fungi (higher fungi). Disease causing fungi are found in both these groups.

The lower fungi

Diseases are caused by three distinct groups of lower fungi. These diseases are discussed below:

- **Diseases caused by lower fungi without hyphae** - are soil borne diseases that have a limited host range. The fungi rest and survive as resting spores in soil or in infected plants. They spread through movement of infected plant material, soil and water. Diseases of this nature are clubroot in crucifers, powdery scab and wart disease in potato and maize brown leaf spot
- **Diseases caused by lower fungi with hyphae and zoospores** – these fungi produce mycelium, form resting spores, produce living swimming spores (zoospores) which infect plants and spread through infected soil, infected plant material and through airborne sporangia. Examples of these type of fungal diseases are downy mildew and late blight.
- **Fungal diseases caused by lower fungi with hyphae but without** zoospores - produce mycelium, produce air-borne thin walled spores and are generally weak parasites which grow on dead plant material. These fungi will attack live plant tissue only if the plant is under stress. Examples of these diseases are pumpkin fruit rot, vegetable soft rot, and bread mould and fruit rot.

The higher fungi

- **Sooty moulds -** cause a flat black coloured film on leaf surfaces which can be rubbed off, leaving a clean surface. It is common in warm, humid areas and is found on all crops. The organisms are not parasitic, but use sugary excretions from aphids as food source. The primary damage caused is lowered photosynthetic rates.
- **Leaf curl** – cause leaf blistering and swelling leading to leaf curl. Blisters are hollow and are found mainly on stone fruits. The disease leads to leaf drop which could weaken trees. The fungus survives in the buds of trees.

- **Powdery mildew** – A common disease white to grey in colour covering either entire leaves or in part and usually both sides of the leaf. Is found on young tissues and only grows on the plant surface. They are parasites and infestations are most severe under warm, dry weather conditions.

Foliar diseases

Generally leafspots and blights, but may also affect other plant parts. May survive in soil or on plant debris

Figure 4.2. Illustration of a leaf infected with late blight. This disease also causes lesions on stems, and brown patched on the skins of tubers rendering tubers unmarketable

- **Alternaria** – a disease in annual crops causing leafspots and blights, may also cause damping off, collar-, fruit- and tuber rot. Common on older plant tissues under nutrient stress. Numerous dark leafspots usually occur on affected plants. Survive on debris and seed.
- **Cercospora** – small, separate leaf-spots, circular to triangular in shape. Found on broadleaf and grass species. Under humid conditions grey mould lesions are visible. Spores are airborne with the disease in most severe under warmer conditions.
- **Septoria** – small leafspots that may join to form blights. Leaves become chlorotic, the infection starting on the lower, older parts gradually progressing upwards.
- **Helminthosporium** – major disease in grass crops, causing leafspots and blight as well as crown and root rot.
- **Stem and twig canker** – starts where the branch or twig is injured, or at the joint of a dead branch or twig. Cankers can kill branches and twigs, the infection is counter acted by the callus formation.
- **Anthracnose** – dark spots or sunken lesions on the leaves, stems, shoots and fruit. Survive on plant debris.
- **Ergot** – common on grass species, produce honey dew in infected florets, which is replaced by hard purple black fungal masses called sclerotia. These are toxic to animals and humans.
- **Botrytis** – common in glasshouse grown crops, causing blossom blight and fruit rot. Grey to brown mould surviving on debris.
- **Vascular wilt** – fungi grow in the vascular systems of the plant, blocking the water transportation, leads to wilting of plant tissues. *Fusarium* and *Verticulum* are soil borne fungi, which are difficult to control.
- **Post harvest decay of fruit and vegetable products** occurs after harvest. Wounding of produce and high temperatures and humidity increases decay.

- **Post harvest decay of stored grain** – is often initiated in the field and causes decay and discoloration of grains decreasing marketability. Some species produce mycotoxins.
- **Rust** – attack many hosts but causes the highest losses in staple crops damaging mainly leaves and stems. Rust to yellow coloured pustules form with gall formation not uncommon. Rusts are parasitic and generally not systemic.
- **Smut –** mostly affect the ovaries of grain crops, but also attack leaves and stems. May become systemic cause stunting and survive on debris and seed.

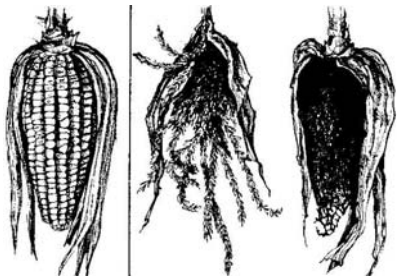


Figure 4.3. Illustration of cob and tassel smut in maize plants (right). The cob on the left is healthy.

- **Rhizoctonia –** root and stem disease, which is soil borne and difficult to control. Survives in soil or in plant material. Symptoms include damping-off, wirestem, cankers, root lesions, rot and potato black scurf.
- **Sclerotonium** – common in wet areas, causes damping-off, stem canker, crown blight and rot, fruit rot and wilt.

3.3 Bacterial diseases

Bacterial diseases are marked by various symptoms, including soft rot, leaf spot, wilt of leaves and stems, canker, leaf and twig blight, and gall formation.

Spots, steaks and blights – these bacteria cause stripes and spots on the leaves, stems and fruit of crop plants. In a few bacterial blights the leaf spots flow into each other. Symptoms are necrotic spots, circular spots with a halo around it. When limited by leaf veins the spots may be angular. On grass crops the symptoms are streaks and stripes rather than spots. Shot hole effects are visible when the infected tissues fall out.

Figure 4.4. Bacterial black spot on fruit and leaves.

- **Vascular wilt** – found mainly on herbaceous crops where the bacteria multiply in the vascular tissue, eventually blocking the transport system. The end results is wilting of the plant and eventual die-back. Discoloration of vascular tissues is not uncommon.
- **Soft rot** – enters plant tissues mainly through wounds and could spread through storage. Leads to separation of plant tissue cells and tissue collapse.
- **Galls** – crown gall in woody species is cause by a bacterium.
- **Cankers –** causes splits and cankers in woody tissues. Spot formation on leaves and fruit and die-back of buds and blossoms.
- **Scab –** the bacterium enters the plant tissue, and the plant cells around the point of entry divide forming layers of corky cells, pushing the infected tissue out, forming the scabs.

3.4 Plant viruses

The major symptoms of virus infections are reduced growth, colour mosaics, ring spots, stem pitting, chlorosis and leaf roll.

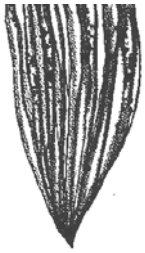


Figure 4.5. An example of streaks on maize leaves, caused by maize streak virus.

- Viruses are not transmitted through rain or wind.
- Virus transmission requires a vector.
- Viruses can be transmitted through movement of plant sap from infected to uninfected plants, such as in grafting.
- Viruses are transmitted through infected seed stocks, through pollen, fungi and especially insects.
- The most virulent plant diseases are transmitted through insect vectors.

3.5 Control of plant diseases

The control of plants diseases rests on five basic principals, exclusion, eradication, protection, resistance breeding and certification.

- **Exclusion** of a disease is based on excluding a disease from an area where the disease in not yet present. Total exclusion is not practical but it can be achieved to some extent through using pathogen free propagation material. For this to be implemented fully a well managed certification scheme is required.

- **Eradication** – eradication of a pathogen is targeted at the method of survival of the pathogen and is aimed at eliminating the pathogen form an area.
- **Protection** – focuses on the protection of the plant against the pathogen. Protection places a barrier between the crop plant and the pathogen. An example of protection against diseases is the implementation of a chemical spray programme for a crop.
- **Resistance breeding** – is the process where the genetic composition of the crop is manipulated so that the crop is resistant to attack from a pathogen.
- **Certification –** includes introducing quarantine measures, as well as certifying propagation materials as disease free. Limiting the transport of potentially infected material from a high risk to a low risk area is also included in the certification system. The success of a certification system relies on good management and the introduction of an inspection system.

3.6 Chemical control of fungal diseases

Chemicals used in the control of fungi are called fungicides. Chemical measures are introduced to aid in eradication of diseases, protecting the crop against diseases and curing the crop from an existing disease.

- **Eradication** of plant diseases involves the control of the target pathogen while the pathogen is still outside the crop plant. This is be done through seed treatments and soil fumigation before planting.
- **Protective measures** are measures taken to place a chemical barrier to the outside of the plant or a systemic compound within the plant. The chemical is applied before the pathogen is present in the plant.
- **Curative measures** are those that are taken once the pathogen has already penetrated the crop. For this type of control the chemical must be taken up by the plant, and must therefore have either a trans-laminar action or a systemic action.
- **Eradicating or curative fungicides** kill the disease on or inside the plant once the disease has developed. **Protective fungicides** form a protective layer around the seed or crop killing fungal spores during their germination.
- Fungicides are divided into three major groupings,
- **systemic fungicides** are taken up by the plant and are translocated within the plant throughout the plant
- **translaminar fungicides** are taken up by the leaves, but are not translocated through the plant
- **broad-spectrum fungicides** refer to those that are effective against different funguses.

In all cases where damage to your crop is expected, speak to an extension officer, pest control expert or representative from pest control or seed and seedling companies for advice or the correct product to use.

3.7 Identification of unknown diseases farm

It is a good practice to have in place a set of procedures for identifying a disease that is unknown to a grower. The steps below are and example of the steps one could follow to handle unknown diseases:

- Sample the diseased plant parts
- Determine the extent of the disease
- Determine the rate of spread
- Have the organism identified- normally done by sending samples to expert plant pathologists, or having them visit the farm for an n site inspection.
- Identify a control strategy
- Apply control strategy.

Please complete Activity 4**:**

Investigate and Report

At your place of work determine the following and write a concise report providing details:

1. What are the major diseases found on the crops that are grown at your place of work?
2. Describe the major symptoms that the disease causes?
3. Describe the monitoring procedures that are followed for diseases at your place of work.
4. At what stage of infection is the disease treated?
5. How is the disease treated – Describe the strategy followed – if this includes chemical treatments, name the compound used, the dosage rates as well as the number of applications, type of application equipment and volume rates used.
6. If an unknown disease is found on the crop, how would you handle this at your place of work?

Concept (SO 4)	I understand this concept	Questions that I still would like to ask
The basic symptoms are which would be looked for when one suspects a disease are described.		
Damage, disease symptoms and weeds are interpreted and explained.		
The monitoring of disease symptoms is explained.		
The possible measures that can be implemented to control diseases before it reaches problem status are described.		
The strategy to treat an unknown disease is described.		
The identification of diseases from plant material is described.		

Session 4 Weeds in agricultural crops

After completing this session, you should be able to:
SO 5: Monitor and report the incidence of weeds in the agricultural enterprise.

In this session we explore the following concepts:

- What is a weed?
- Weed management
- Methods of Weed Control
- Identification of unknown weeds

4.1 What is a weed?

A weed is defined as a plant that grows out of place. Out of place is defined by humans and depends on specific situations. So weeds are plants that interfere with human activity. It is clear then that there is no ecological or botanical or even scientific justification of the characterisation of weeds.

In an ecological sense, a weed is but one of the partners in the ecosystem in which it develops. This holds true for both invasive species as well as crop weeds. Weeds become problem plants when the need of the weed species overlaps with the crop plant or natural vegetation, and the weed species has the ability to out-compete the "wanted" species. The competition is for growth factors such as water, nutrients, space and sunlight. In the situation where the weed plants become problem plants, the weedy species may be a useful plant, but because of the situation that it is in, it becomes a weed plant. Most of the common weed species are also highly successful plants in an ecological sense.

There are approximately 200 important agricultural weed species. The weeds fall within more than 12 different plant families.

Weeds do however have some common characteristics, which make them important weed species. These characteristics include high seed viability, rapid seed emergence, rapid initial plant growth, strong competitors and produce large numbers of seed.

Weeds can be further classified according to the time it takes for the plant to complete its life cycle. There are three groups of weeds classified according to the time for completion of the lifecycle as **Annual weeds**, **Biennial weeds** and

Perennial weeds. Approximately two-thirds of the important weed species are annuals, with the rest predominantly perennials with only a small proportion being biennial plants. The lifecycle of a plant is defined as the time from seed emergence to the time of seed production i.e. from seed to seed.

- **Annual weeds**

Annual weeds complete their life cycle in one growing season, thus in less than one year. Due to their short lifecycle annuals produce large numbers of seed and grow very rapidly. These plants are sensitive to weed control practices.

Annual weeds can further be divided into two groups. **Summer annuals**, which germinate in the spring or early summer, grow in the summer, mature and form seed in the autumn. Summer Annuals complete the cycle seed to seed across two calendar years but in one growing season. **Winter annuals** germinate in autumn or early winter and mature and form seed in spring or early summer. So winter annuals complete the cycle in one calendar year and in one growing season. Annuals do not live for time periods exceeding 12 months and reproduce primarily through seed.

- **Biennial weeds**

Biennial weeds live longer than one year but not longer than two years. Biennial weeds usually have a fleshy tap root system for the storage of food sources. Biennials are not abundant in South Africa.

- **Perennial weeds**

Perennial weeds reproduce every year by through vegetative organs such as rhizomes and stolons, bulbs and tubers, root and stem cuttings and can generally also form seed. Perennials can be sub-divided into two groups' namely **simple perennials** and **creeping perennials**. **Simple perennials** reproduce only through of seed. Should the shoot of a simple perennial be damaged, new buds can form. **Creeping perennials** reproduce through seed and vegetative parts. Vegetative reproduction usually occurs through creeping surface roots or stolons, underground stems or rhizomes, tubers and bulbs.

4.2 Weed management

The influence of weeds on a crop and natural vegetation and the rate and **extent** of weed growth is more predictable than that of crop pest. Weeds cab therefore be better managed than the other pests and diseases. Weed control can be viewed at different levels as prevention, control and eradication.

- **Prevention**

Prevention is the measures taken to prevent a new weed from entering an area. Preventive measures must also be taken to prevent weed seed from forming. Prevention includes avoiding:

- Crop seed contaminated with weed seed
- Spreading plant parts with implements
- Using contaminated manure
- Using contaminated irrigation water.
- The formation of seed on the weed plant
- spreading of vegetative reproductive plant parts

Control

Weed control is the general objective in weed management. Chemical and mechanical weed control is the most predominant weed control techniques used. Weed control performed to reduce the numbers of weeds such levels that they do not adversely affect crop yield or interfere with the harvesting process. A balance must be struck between weed control costs and economic advantages in the form of larger profits.

Eradication

Weed eradication is the elimination of weed plants and their reproductive capacity from an area. The only manner in which eradication can be performed in soil, is fumigation with soil sterilants. Such application of fumigants is expensive and profitable only when used on small areas of high-production soils or systems with the production of high value horticultural and vegetable speciality crops.

4.3 Methods of weed control

Weeds can be controlled using four major strategies. These strategies include mechanical control, control through cultivation practices, chemical control and biological control.

Weed control - mechanical weed control.

Mechanical weed control includes cultivation of fields, hand hoeing, mowing, the use of mulches, burning of fields and flooding of fields.

- Cultivation – Cultivation can be divided into two forms of cultivation, primary cultivation and secondary cultivation. Primary cultivation includes conventional ploughing and is aimed primarily at soil preparation, whereas secondary cultivation is a shallower disturbance aimed at weed control or breaking surface crusting. During tillage weed seed can be brought from deeper soil layers to the surface, which could stimulate seed germination.
- Mechanical hoeing – the development of row cropping systems was centred on facilitating cultivation. Mechanical hoeing can only be carried out in such row crops. The cultivation process breaks the contact between the weed roots and the surrounding soil and may even separate foliage, from roots burying foliage and seed. The best soil conditions for hoeing are those where the top-soil is dry and sub-soil is wet. When hoeing by hand cultivation is more selective than

mechanical hoeing. However high labour costs make hand hoeing an uneconomic, yet it remains highly effective and important in subsistence farming systems.

- Mowing prevents seed formation and exhausts food reserves in perennial weeds. Mowing favours crops that are adapted to mowing. Mowing also has some disadvantages such as benefiting weeds growing below the cutting line and shifting the weed spectrum from upright growers to prostrate growers.
- Mulches - smother weeds that are cover in much primarily due to light deprivation. Mulches can be made from materials such as plastic, straw or other plant residues. Cover crops can also serve as mulches.
- Burning – needs to be controlled. Burning is non selective and may stimulate the emergence of certain weed species.
- Flooding - Weed control by flooding of lands with water has a limited application. Soil saturated with water has a low oxygen content and it is this factor that causes the drowning of plants. Seeds of plants sensitive to low oxygen concentrations in soil will remain dormant. Flooding is used in rice fields to control certain weeds as rice can tolerate waterlogged conditions.

Weed Control - Cultivation Practices

Weed control through cultivation practices is relevant only to weed control in agriculture. It must be kept in mind that management practices of natural fields and pastures could also aid in managing encroachment and invader species. Weed control through cultivation practices starts with the **crop selection**. The choice of the crop determines the weed control programme to be used. Crop choice may also guide the programme developer as to the weed spectrum he could expect to encounter. Crops that germinate rapidly and produce leaf cover in volume, will quickly develop a head start on the competing weeds. Once a crop has been selected the next consideration is that of **time of planting.** Early planting may favour crops adapted lower temperatures over a weed that which may not be adapted thereto. A disadvantage of early planting may be extended periods of chemical weed control, which may lead to increased input costs. **Plant spacing** is also of importance, as dense crop stands in narrow rows will naturally suppress weed growth by depriving them of light. The growth of the crop can be manipulated through **fertilisation and irrigation**. The addition of extra fertilisation is not always effective in overcoming the weed competition since the weed may also react positively to fertilisation.

Weed Control - Chemical

A **herbicide** is mixture of chemicals prepared to suppress plant growth or kill plants. The wide use of herbicides in crop fields and on range-land is based primarily on **herbicide selectivity.** As a result of selectivity herbicides can be used on crop plants for weed control without causing damage to the crop plant.

Herbicides are made up of chemical compounds known as **active ingredients** (**a.i.**). The a.i. is the chemical compound, which affects the life processes within the

plant eventually leading to death or plant damage. The herbicides are sold as **herbicide formulations,** which are a combination of active ingredient and other chemicals. A formulation can be a liquid or a solid consisting of particles of different sizes.

Formulations also contain **solvents** to disperse the active ingredient, **stabilisers** to prevent the active ingredient from reacting with other chemicals and to prolong its shelf-life, **emulsifiers** to enable the activie ingredient to mix with water or oils, **adjuvants** to improve its entry into the plant and **dyes**, which are inert substances but show where the herbicide has been applied. The addition of dyes to a formulation is especially handy where invader species are controlled.

The herbicide which is sold is referred to as a **formulated product** or **product**. The formulated product may require dilution before it can be applied. The dilution of the product is made by mixed it with a suitable **carrier** to ensure an even distribution of the active ingredient over the target plants. Most active ingredients are formulated so that they mix in water and thus water is the most common carrier, but diesel is also used in specific situations, such as the application of Garlon® in cut stump treatments.

- Herbicide Selection

When selecting a herbicide for use it is important that one knows what the desired end result of the application is. Then only can a decision be made as to the type of herbicide that will be required. Herbicides can be classified in a number of ways. The most useful classifications are those that aid in the selection process. Herbicides are classified according to their ability to be transported or translocated in a plant, the compounds ability to selectively kill weed species and not damage desired plants, their persistence in the soil environment and the mobility of a herbicide in the soil. In the crop situation herbicides may also be classed according to the time of application, relative to the growth stage of the crop.

In all cases where weeds are found in your crop, speak to an extension officer, pest control expert or representative from pest control or seed and seedling companies for advice or the correct products to use, to suit the weed type.

Weeds in different areas may differ greatly. There are many good books available that will help you identify the weeds of your area. Use a book such as “Problem Plants of South Africa” by Clive Bromilow to identify the weeds in your area. Then see if you can identify the suitable herbicides you can use to control these.

4.4 Identification of unknown weeds

Where you cannot identify a particular weed, collect a specimen, take close up photographs of the plant as a whole and individual plant parts and show them to an expert to help you identify them. You can also collect seed of the plant for identification purposes. However accurate identification of weed species from seed is very difficult. It is best to take the seed sample and have an expert do the identification. If there is not expert in your area, send the photographs and seeds to the agricultural or botany department of a university closest to you.

When an unknown weed is observed, this could be a potential problem plant. It could be weed, and it is important that its weed status is known. Only then can a land owner decide whether it requires any form of control. If you cannot identify the plant, a sample must be collected and this sent for identification to an expert body as described in the paragraph above.

To collect a sample you need to sample all of the plant parts that are available. Collect a whole intact plant including the root system where possible. Take photographs of the plant from all possible angles, where it grows in the field. If the plants grow in close clusters together, take photographs of this as well. Map the area where the plants were found, and note the size of the area that is covered in these plants. Also determine the density of the plant stands. To determine the plant density you will need a sturdy square frame ideally 1m X 1m. Place the square over the areas where the unknown plant grows, and count the number of individual plants in the square. This will provide you with a plant density as a number of plants per square metre. Now repeat this exercise on at least 10 other areas or spots where the plants are found. You can now calculate the average plant density. You can also determine whether the density changes in different fields etc.

Send this information as well as the plant samples to the institution that will identify the plant.

The plant material, representative of the plant as it is growing in the fields as well as a whole plant (where possible) must be placed in plastics bags and sent for identification. If the time lapse between sampling and arrival at the identification body is less than 24 hour, you can send the samples fresh. If this is not possible the plants have to be dried between layers of newspaper and pressure placed on the paper to flatten the plant parts as far as possible. Only send the samples when they have dried. The pressure can be applied by placing the plant parts neatly on a piece of paper, then placing another sheet on top. Place a layer of adsorbent paper over and below the covered sample. Place layered sample between heavy books and strap together with a suitable belt or rope. Place the sample in a cool dry place to dry.

When collecting seed, it is important that the seed i collected together with the seed carrying structures. This is especially important where seeds are collected from grassy weeds. Grasses are normally identified according to seeds collected, and it s

critical that these are intact. Place the seeds and seed structures in a suitable container and send these for identification.

Please complete Activity **5:**

Investigate and Report

At your place of work determine the following and write a concise report providing details:

1. What are the major weed species found in the area where your place of work is located.
2. How is weeds monitoring applied at your place of work.
3. Describe and demonstrate the weed monitoring procedures used on farm
4. Describe how you would collect seeds and plant material from unknown weeds observed at your place of work and how you would go about having these identified. Ensure that the on farm procedures are followed.

Concept (SO 5)	I understand this concept	Questions that I still would like to ask
The characteristics of the most common weeds associated with the agricultural enterprise are explained.		
Monitoring and control of weeds is described.		
The collection of unknown seed is explained.		
The strategy to identify unknown seed is described.		

My Notes ...

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Am I ready for my test?

- Check your plan carefully to make sure that you **prepare in good time**.
- You have to be found **competent** by a qualified **assessor** to be declared competent.
- Inform the assessor if you have any **special needs** or requirements **before** the agreed date for the test to be completed. You might, for example, require an interpreter to translate the questions to your mother tongue, or you might need to take this test orally.
- Use this worksheet to help you prepare for the test. These are **examples** of **possible questions** that might appear in the test. All the information you need was taught in the classroom and can be found in the learner guide that you received.

1. ***I am sure*** *of this and understand it well*
2. ***I am unsure*** *of this and need to ask the Facilitator or Assessor to explain what it means*

Questions	1. I am sure	2. I am unsure
1. Explain why pest weeds and diseases should be monitored.		
2. Describe and discuss the most commonly used monitoring techniques used in your industry.		
3. Explain the difference between predator and pests.		
4. Identify the major weeds relevant to your crop industry		
5. Identify the major insect pests relevant to your crop industry		
6. Identify the major forms of disease damage to your crop industry		
7. Why is it important to keep a record of the pest monitoring data?		
8. Name the major forms of monitoring tools for insect pest used in your crop and describe how they are implemented.		
9. Name the major diseases of relevance to your crop, and discuss how they are identified.		
10. Name the 5 most important weeds in your area		

11. Discuss the monitoring system used in your industry for the identification of weed problems. Start with the process of weed identification.		
12. Explain the three levels of weed management		

My Notes ...

Checklist for practical assessment ...

Use the **checklist** below to help you prepare for the part of the practical assessment when you are observed on the **attitudes** and **attributes** that you need to have to be found competent for this learning module.

Observations	Answer Yes or No	Motivate your Answer (Give examples, reasons, etc.)
Can you identify problems and deficiencies correctly?		
Are you able to work well in a team?		
Do you work in an organised and systematic way while performing all tasks and tests?		
Are you able to collect the correct and appropriate information and / or samples as per the instructions and procedures that you were taught?		
Are you able to communicate your knowledge orally and in writing, in such a way that you show what knowledge you have gained?		
Can you base your tasks and answers on scientific knowledge that you have learnt?		
Are you able to show and perform the tasks required correctly?		
Are you able to link the knowledge, skills and attitudes that you have learnt in this module of learning to specific duties in your job or in the community where you live?		

- The assessor will complete a checklist that gives details of the points that are checked and assessed by the assessor.
- The assessor will write commentary and feedback on that checklist. They will discuss all commentary and feedback with you.
- You will be asked to give your own feedback and to sign this document.
- **It will be placed together with this completed guide in a file as part of you portfolio of evidence.**
- The assessor will give you feedback on the test and guide you if there are areas in which you still need further development.

Paperwork to be done ...

Please assist the assessor by filling in this form and then sign as instructed.

Learner Information Form				
Unit Standard	**116265**			
Program Date(s)				
Assessment Date(s)				
Surname				
First Name				
Learner ID / SETA Registration Number				
Job / Role Title				
Home Language				
Gender:	Male:		Female:	
Race:	African:	Coloured:	Indian/Asian:	White:
Employment:	Permanent:		Non-permanent:	
Disabled	Yes:		No:	
Date of Birth				
ID Number				
Contact Telephone Numbers				
Email Address				
Postal Address			Signature:	

Bibliography

Books:

Books and Guides

Myburghs Crop pest of South Africa Volumes 1-4. ARC publication. Available on CD and in book form from the ARC.

Alien Weeds and Invasive Plants. A complete guide to declared weeds and invaders in South Africa. By Lesley Henderson. An ARC publication.

Problem plants of South Africa. BY Clive Bromilow. A Struik Publication.

Publications

Farmers Weekly Magazine

Landbou Weekblad Magazine

World Wide Web:

Department of Agriculture Web Site: www.nda.agric.za

Terms & Conditions

Acknowledgements

Project Management:

IMPETUS Consulting and Skills Development

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Layout:

Ms A du Plessis

SOUTH AFRICAN QUALIFICATIONS AUTHORITY

REGISTERED UNIT STANDARD:

Monitor pests, diseases and weeds on crops

SAQA US ID	UNIT STANDARD TITLE		
116265	Monitor pests, diseases and weeds on crops		
SGB NAME	**NSB**	**PROVIDER NAME**	
SGB Primary Agriculture	NSB 01-Agriculture and Nature Conservation		
FIELD		**SUBFIELD**	
Agriculture and Nature Conservation		Primary Agriculture	
ABET BAND	**UNIT STANDARD TYPE**	**NQF LEVEL**	**CREDITS**
Undefined	Regular	Level 3	2
REGISTRATION STATUS	**REGISTRATION START DATE**	**REGISTRATION END DATE**	**SAQA DECISION NUMBER**
Registered	2004-10-13	2007-10-13	SAQA 0156/04

PURPOSE OF THE UNIT STANDARD

A learner achieving this standard will be able to recognize, monitor and apply basic control of insects, plant diseases and common weeds, in a specific agricultural enterprise. In addition they will be able to report their findings to management or advisors.

Learners will gain an understanding of sustainable agricultural practices as applied in the animal-, plant and mixed farming sub fields. This unit standard focuses on the application of pest control practices in primary agriculture.

They will be able to participate in, undertake and plan farming practices with knowledge of their environment. This unit standard will instil a culture of maintenance and care for both the environment as well as towards farming infrastructure and operations.

LEARNING ASSUMED TO BE IN PLACE AND RECOGNITION OF PRIOR LEARNING

It is assumed that a learner attempting this unit standard will show competence against the following unit standards or equivalent:

- NQF 3: Demonstrate a basic understanding of the physiological functioning of the anatomical structures of the plant.
- NQF 2: Control pests and diseases ad weeds on crops effectively and responsibly.

UNIT STANDARD RANGE

Whilst range statements have been defined generically to include as wide a set of alternatives as possible, all range statements should be interpreted within the specific context of application.

Range statements are neither comprehensive nor necessarily appropriate to all contexts. Alternatives must however be comparable in scope and complexity. These are only as a general guide to scope and complexity of what is required.

UNIT STANDARD OUTCOME HEADER

N/A

Specific Outcomes and Assessment Criteria:

SPECIFIC OUTCOME 1

Monitor the common pests prevalent in the specific agricultural enterprise.

OUTCOME RANGE

Monitoring includes but is not limited to visual scouting of plant material and monitoring of traps etc.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The pest monitoring process for the specific agricultural enterprise is explained.

ASSESSMENT CRITERION 2

The significance for the monitoring of pests is explained.

ASSESSMENT CRITERION 3

The differences between pests and predators are explained.

ASSESSMENT CRITERION 4

The relationship between pests and predators with relation to control measures is explained.

ASSESSMENT CRITERION 5

The ability to observe, categorize and report any new plant damage is demonstrated.

ASSESSMENT CRITERION 6

The importance of the recording of data is explained.

SPECIFIC OUTCOME 2

Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases and weeds.

OUTCOME RANGE

Trapping includes but is not limited to pheromone traps, sticky traps, pit-fall traps etc, monitoring includes but is not limited to checking of traps, assessing leaves, branches, stems, fruit etc. and recording includes but is not limited to verbal, written or mechanical.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The different types of traps that can be used in pest monitoring is explained.

ASSESSMENT CRITERION 2

The significance of these traps and how they are assessed is explained.

ASSESSMENT CRITERION 3

The techniques of monitoring pests when traps are not used are explained.

ASSESSMENT CRITERION 4

The monitoring of diseases and weeds is explained.

ASSESSMENT CRITERION 5

Different methods of recording the data are explained.

ASSESSMENT CRITERION 6

The use of data to control pests is explained.

SPECIFIC OUTCOME 3

Collect insects not familiar and that had been identified.

OUTCOME RANGE

Collecting of pests includes but is not limited to placing unknown pests in containers and preparing it to be sent for identification or sending insect trap bottoms with unknown insects to a laboratory for identification.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The need to trap, collect and send unknown pests for identification especially when occurring in large numbers is explained.

ASSESSMENT CRITERION 2

The way in which these pests will be collected and where they could be sent for identification is described.

ASSESSMENT CRITERION 3

The reasons for identifying pests are explained.

SPECIFIC OUTCOME 4

Monitor the symptoms of disease associated with the agricultural enterprise.

OUTCOME RANGE

Diseases include but are not limited to diseases on crops, those of animals, or any other agricultural enterprise.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The basic symptoms are which would be looked for when one suspects a disease are described.

ASSESSMENT CRITERION 2

Damage, disease symptoms and weeds are interpreted and explained.

ASSESSMENT CRITERION 3

The monitoring of disease symptoms is explained.

ASSESSMENT CRITERION 4

The possible measures that can be implemented to control diseases before it reaches problem status is described.

ASSESSMENT CRITERION 5

The strategy to treat an unknown disease is described.

ASSESSMENT CRITERION 6

The identification of diseases from plant material is described.

SPECIFIC OUTCOME 5

Monitor and report the incidence of weeds in the agricultural enterprise.

OUTCOME RANGE

Weeds include but are not limited to unwanted plant growth in an agricultural enterprise.

ASSESSMENT CRITERIA

ASSESSMENT CRITERION 1

The characteristics of the most common weeds associated with the agricultural enterprise are explained.

ASSESSMENT CRITERION 2

Monitoring and control of weeds is described.

ASSESSMENT CRITERION 3

The collection of unknown seed is explained.

ASSESSMENT CRITERION 4

The strategy to identify unknown seed is described.

UNIT STANDARD ACCREDITATION AND MODERATION OPTIONS

The assessment of qualifying learners against this standard should meet the requirements of established assessment principles.

It will be necessary to develop assessment activities and tools, which are appropriate to the contexts in which the qualifying learners are working. These activities and tools may include an appropriate combination of self-assessment and peer assessment, formative and summative assessment, portfolios and observations etc.

The assessment should ensure that all the specific outcomes, critical cross-field outcomes and essential embedded knowledge are assessed.

The specific outcomes must be assessed through observation of performance. Supporting evidence should be used to prove competence of specific outcomes only when they are not clearly seen in the actual performance.

Essential embedded knowledge must be assessed in its own right, through oral or written evidence and cannot be assessed only by being observed.

The specific outcomes and essential embedded knowledge must be assessed in relation to each other. If a qualifying learner is able to explain the essential embedded knowledge but is unable to perform the specific outcomes, they should not be assessed as competent. Similarly, if a qualifying learner is able to perform the specific outcomes but is unable to explain or justify their performance in terms of the essential embedded knowledge, then thy should not be assessed as competent.

Evidence of the specified critical cross-field outcomes should be found both in performance and in the essential embedded knowledge.

Performance of specific outcomes must actively affirm target groups of qualifying learners, not unfairly discriminate against them. Qualifying learners should be able to justify their performance in terms of these values.

- Anyone assessing a learner against this unit standard must be registered as an assessor with the relevant ETQA.

- Any institution offering learning that will enable achievement of this unit standard or assessing this unit standard must be accredited as a provider with the relevant ETQA.

- Moderation of assessment will be overseen by the relevant ETQA according to the moderation guidelines in the relevant qualification and the agreed ETQA procedures.

UNIT STANDARD ESSENTIAL EMBEDDED KNOWLEDGE

The person is able to demonstrate a basic knowledge of:

- Insect anatomy.
- Common plant diseases.
- Common pests.
- Common predators.
- Common beneficial insects.
- Common diseases.
- Life cycle of an insect.
- Natural enemies.
- Ways of spreading.
- Contamination.
- Implication of contamination on the quality and marketability of the product.
- Importance of hygiene.
- Scouting procedures.
- Record keeping.
- Hygiene.
- Spreading of pests and diseases.

UNIT STANDARD DEVELOPMENTAL OUTCOME

N/A

UNIT STANDARD LINKAGES

N/A

Critical Cross-field Outcomes (CCFO):

UNIT STANDARD CCFO IDENTIFYING

Problem solving relates to specific outcomes:
- Monitor the common pests prevalent in the specific agricultural enterprise.
- Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases and weeds.
- Collect insects not familiar and that had been identified.
- Monitor the symptoms of disease associated with the agricultural enterprise.

UNIT STANDARD CCFO ORGANIZING

Self-organisation and management relates to specific outcomes:
- Monitor the common pests prevalent in the specific agricultural enterprise.
- Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases

and weeds.
- Collect insects not familiar and that had been identified.
- Monitor the symptoms of disease associated with the agricultural enterprise.

UNIT STANDARD CCFO COLLECTING

Information evaluation relates to specific outcomes:
- Monitor the common pests prevalent in the specific agricultural enterprise.
- Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases and weeds.
- Collect insects not familiar and that had been identified.
- Monitor the symptoms of disease associated with the agricultural enterprise.

UNIT STANDARD CCFO COMMUNICATING

Communication relates to specific outcomes:
- Monitor the common pests prevalent in the specific agricultural enterprise.
- Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases and weeds.
- Collect insects not familiar and that had been identified.
- Monitor the symptoms of disease associated with the agricultural enterprise.

UNIT STANDARD CCFO SCIENCE

Science and technology relates to specific outcomes:
- Monitor the common pests prevalent in the specific agricultural enterprise.
- Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases and weeds.
- Collect insects not familiar and that had been identified.
- Monitor the symptoms of disease associated with the agricultural enterprise.

UNIT STANDARD CCFO DEMONSTRATING

The world as a set of related systems: relates to specific outcomes:
- Monitor the common pests prevalent in the specific agricultural enterprise.
- Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases and weeds.
- Collect insects not familiar and that had been identified.
- Monitor the symptoms of disease associated with the agricultural enterprise.

UNIT STANDARD CCFO CONTRIBUTING

Self-development relates to specific outcomes:
- Monitor the common pests prevalent in the specific agricultural enterprise.
- Demonstrate a basic knowledge of trapping, monitoring and recording the incidence of pests, diseases and weeds.
- Collect insects not familiar and that had been identified.
- Monitor the symptoms of disease associated with the agricultural enterprise.

UNIT STANDARD ASSESSOR CRITERIA

N/A

UNIT STANDARD NOTES

N/A