Contents of Module 6

Introduction to Plant Protection

Pest, Diseases and Weeds in Citrus Nurseries

A citrus nursery is a business that has to be managed very carefully for it to succeed. One of the most important factors to consider in citrus tree production is the impact of pests and diseases. Citrus attracts a great variety of pests and diseases that cause damage to the tree. Because a nursery is a concentration of young trees, it provides a rich food-source for many insects in the immediate vicinity.

Pests refer to insects and other organisms that invade, eat, scar, or in any other way harm any part of the plant (leaves, stems and roots). It is important to know and understand the difference between insects that are pests and insects that are beneficial, and apply control methods that maintain a balance.

Controlling diseases is very important in commercial citrus tree production, because some diseases can cause a nursery to be placed under quarantine. Nursery trees are also sometimes transported to farms that are from the nursery itself, which means that nursery trees can also be a vehicle for spreading disease pathogens. It is important to know what diseases to watch out for, and how to monitor the nursery frequently in order to avoid financial disaster.

Nursery trees will also not be certified by the Citrus Improvement Scheme (CIS) if any live pest insects are detected on them, or if they are infected by disease.

Weeds are all plants that compete with citrus trees for resources and cause decreased production. Weeds impact on successful citrus nursery production because they compete with citrus trees for water and nutrients and because they provide a host for pest insects and diseases. It is important to know how to control weeds, and consider control methods that will not cause the ecosystem to become unbalanced, causing a rise in other pests and micro-organisms.

Plant Protection Measures

Control measures for certain common pests and diseases and for weeds, are implemented as a matter of routine, even if those pests and diseases have not been specifically identified in the nursery. An example of such a pest is citrus psylla, and an example of a disease is blackspot. These control measures are incorporated into a plant protection program that is strictly followed.

The citrus nurseryman must however be constantly vigilant for attacks from other pests and diseases and for outbreaks that were not sufficiently controlled by the plant protection program. The presence of weeds must also be monitored closely.

Scouting is essential in this regard, and the citrus nurseryman and his staff require the necessary skills and knowledge for identifying pests, disease symptoms and weeds that will allow the nursery manager to react with the appropriate control measures.

Prescribed Material

The following material is prescribed for this module:

Identification Manual for Citrus Pests and Their Natural Enemies published by Citrus Research International. Contact details for orders: (013) 759-8000 or bella@cri.co.za.

practical

Activity 6.1 – Brainstorm

Brainstorm with your co-workers and find answers to the following questions:

- ✓ What is meant by a citrus pest?
- ✓ Name one citrus pest that you are familiar with in the citrus nursery.
- ✓ What is meant by a citrus disease?
- ✓ Name one citrus disease that you are familiar with in the citrus nursery.
- ✓ What is your understanding of 'plant protection measures' in the citrus nursery?

summary

Introduction to Plant Protection

- ➢ A very important factor in citrus tree production is the impact of pests and diseases on young nursery trees.
- ➢ Pests refer to insects and other organisms that invade, eat, scar, or in any other way harm any part of the plant, such as the leaves, stems and roots.
- ➢ Controlling diseases is very important in terms of commercial citrus tree production, because some diseases can cause a nursery to be placed under quarantine.
- ➢ Nursery trees will not be certified by the Citrus Improvement Scheme (CIS) if any live pest insects are detected on them, or if they are infected by disease.
- ➢ Weeds are all plants that compete with citrus trees for resources and cause inferior production.
- ➢ Control measures for certain common pests and diseases and for weeds, are implemented as a matter of routine, even if those pests and diseases have not been specifically identified in the nursery.

Common Citrus Pests

Introduction

There are numerous insects and organisms that can be found in a citrus nursery. Some are beneficial, while others are considered pests. The majority of citrus pests are insects, but not all insects are pests. An insect becomes a pest in a citrus nursery when it feeds at a vulnerable stage on the branch or leaf of the young tree, causing damage.

A few examples of citrus pests in the nursery are:

- Citrus psylla is a vector for the pathogen that causes greening disease
- Thrips cause deformation of young leaves
- Red mite cause damage to older leaves
- Orange dog feeds on leaves

definition

Vector

A vector is an organism, such as an insect, that transmits disease-causing micro organisms from infected plants to other plants.

It is vital that workers in citrus nursery are familiar with the different organisms so that they are able to report pests and keep an eye on the size of the pest populations. Successful pest control requires immediate action against pest populations before they are too high and damage to the plants is too extensive.

Pest and Beneficial Insects

definition

Pest Organisms

In agriculture, pest organisms are organisms that cause damage to livestock, crops, humans, or land fertility, for instance tsetse fly, fruit fly and malaria mosquitoes. In the nursery, citrus pests are organisms whose feeding and / or reproductive habits lead to a reduction in the quality of the citrus trees produced.

Beneficial Organisms

In agriculture, beneficial organisms contribute positively by their habits, for example by feeding on pest organisms or by pollinating flowers to enable fruit development.

Not all insects are pests. Bees are for example good insects since they provide honey and pollinate flowers. There are also insects that attack citrus pests. *Aphytis* and Comperiella wasps are parasites that lay their eggs in the pest red scale, eventually killing it. *Chilocorus nigritus* ladybird beetles are predators that feed on red scale and aphids. These are beneficial insects for citrus production.

Beneficial insects such as these are used in some cases in commercial citrus production to control pests as part of a biological pest control program. In citrus nurseries, however, it is not practical to use biological control measures, and chemical control is used exclusively.

Pest Damage

Insect damage falls in one of the following categories:

- Stinging
- Biting plant parts
- Sucking plant sap
- Laying eggs in plant parts leading to the hatching of larvae that feed on the plant parts
- Serving as a vector for other diseases

Common Citrus Pests

The most common citrus pests are described in the **Identification Manual for Citrus Pests and Their Natural Enemies**, which is prescribed material for this learning module.

The Identification Manual is published by Citrus Research International for the Southern African citrus industry. The manual shows and describes what each pest looks like at various stages during its development and the damage that the pest causes.

Controlling Pests in Citrus Nurseries

The following main control measures are used for controlling pests in citrus nurseries:

- **Contact chemical sprays** that affect insects that come into contact with the chemical when they move over the area where the chemical has been applied or when they chew or suck on the plant where the chemical has been applied.
- **Systemic chemicals** that penetrate plant parts and poison insects that chew them.

practical

Activity 6.2 – Mind Map

Design an educational mind map for nursery workers that explains the following:

- ✓ What is the difference between a beneficial organism and a pest organism?
- ✓ How will you know whether you are dealing with a pest organism in the citrus nursery?

summary

Common Citrus Pests

- The majority of citrus pests are insects, but not all insects are pests.
- Pests are those insects that damage the trees, while beneficial insects assist in pest control through predatory or parasitic behaviour.
- Insects damage plants by sucking, stinging or chewing the plant parts, laying eggs on or in plant parts, or by acting as a vector for diseases.
- The most common citrus pests are described in the Identification Manual for Citrus Pests and Their Natural Enemies, published by the CRI.
- The main control measures used in citrus nurseries are contact chemical sprays and systemic chemicals.

Common Citrus Diseases

Introduction

Healthy citrus nursery trees can be sold for a healthy profit. A citrus plant is healthy and normal when it can carry out its physiological functions, which are described in detail in the earlier modules of this learning program, and that include:

- The absorption and transportation of water and nutrients
- Photosynthesis, respiration and transpiration
- Division and elongation of cells in order to grow

Citrus diseases mostly impact on the ability of the plant to carry out these functions, by infecting and damaging plant parts and in the process reducing or even destroying the ability of the part to fulfil its functions. This leads to reduced growth of the plant, and may even lead to the death of the plant.

Apart from this direct impact on the quality of nursery trees, certain diseases are considered to serious, and their containment seen as so important, that a nursery can be placed under quarantine to prevent the spreading of the disease.

Diseases can therefore pose a serious threat to the financial wellbeing of a citrus nursery.

Disease Classifications

definition

Plant Disease

A plant disease can be described as an impairment of the plant's functions by organisms such as fungi, bacteria or viruses.

Plant diseases are classified as biotic or abiotic.

Biotic Diseases

Biotic diseases are caused by micro-organisms such as fungi, bacteria or viruses. Some disease-causing agents are restricted to certain parts of the plant, such as the root, trunk or leaves, while others may affect several or all parts of the plant.

Fungal Diseases

Fungal diseases are caused by organisms called **fungi**. Fungi attack plants by attaching to the plant surface and feeding on the plant by dissolving the tissue to

absorb the nutrients. Fungal diseases are controlled through chemical applications.

Warm, humid conditions are ideal for fungal growth. As we have seen in previous modules, these are also the environmental conditions that are most suited to plant production and that are created in germination rooms and greenhouses (tunnels), which means that nursery structures create very good conditions for the development of fungi.

The most common fungal diseases in citrus nurseries are:

- *Phytophthora*
- *Pythium*
- *Fusarium*
- Blackspot
- Damping off
- Albinism
- *Alternaria* brown spot
- Sooty mould
- Citrus scab
- Trichoderma

Viral Diseases

Viral diseases are caused by viruses, which inject their genetic material into the plant (the host) to multiply. Viruses destroy their host's cells because the host cell bursts when it releases the new viruses. There is often no cure for viral diseases and trees have to be replaced. Viral diseases therefore have to be prevented at all cost – once they are present in the nursery, they cannot be removed.

The most common viral diseases in citrus are *Tristeza* and *Exocortis*.

Bacterial Diseases

Bacterial diseases are caused by organisms that reproduce very quickly. The most common bacterial diseases in citrus are Citrus Canker, Pseudomonas leaf spot and greening disease. Bacterial diseases can generally also not be cured, and prevention remains the main aim.

Abiotic Diseases

Abiotic diseases are caused by adverse environmental conditions, nutritional deficiencies or excesses, genetic defects, and incorrect cultural practices. Abiotic diseases are best treated through prevention, which implies sound cultural and production practices.

Disease Symptoms

Disease symptoms develop because there is an interference with the plant's functions. Unlike insect pests, which can be detected in the nursery, diseases are often not detected until the plant shows symptoms of the disease. It is important that nursery workers know what healthy plants look like and that they are on the lookout for disease symptoms and signs that plants are infected by disease.

It is however always important to remember that many disease symptoms are similar to those of nutrient deficiencies or other abiotic conditions. The presence of symptoms does therefore not automatically mean that a biotic disease is present. All diseases must be diagnosed and confirmed by experts. The most common disease symptoms are:

- Wilting
- Discolouration of plant material
- Gum formation (gummosis)
- Dieback

Wilting

If plants wilt and it is not due to other factors such as transplant shock or a lack of water, it may be an indication of disease. Wilting may be occurring because nutrients and water cannot move to the different plant parts, as a result of an adverse effect on the transportation system of the plant (the xylem and phloem).

This may be due to the transportation vessels being blocked by the disease-causing organism or to scarring or cancer formation inside the transportation vessels in response to the disease organism. It can also be due to the disintegration of specific plant parts, such as the roots.

Examples of diseases that may cause wilting are root rot (caused by *Phytophthora* or *Pythium* spp.), collar rot (caused by *Phytophthora* spp.) and seedling damping-off (caused by *Fusarium oxysporum*).

Discolouration

Some diseases can be detected by a change in the colour of plant parts, such as yellowing of leaves or greening of fruit.

For example, necrosis is seen when parts of the plant tissue dies and forms brown or black dry masses on the affected plant parts. This is most often recognised by dry spots on the leaves, and is often caused by fungi such as *Alternaria*.

Chlorosis (yellowing) of foliage is often caused by malnutrition due to inefficient water and nutrient uptake as the result of damage to root systems by *Phytophthora* spp. It can be an early symptom of root rot.

Gum Formation (Gummosis)

Gummosis is widely encountered throughout the plant kingdom. Gum formation on the trunk or branches is the most commonly observed symptom of gummosis. Gum forms and exudes from blisters containing gum pockets, usually on the trunk. The wood beneath the blister shows a pink-orange or brown discolouration.

Gum formation in plants is induced by environmental stress factors such as insect attack, infection, flooding, cold damage, salt accumulation, and mechanical injury.

Gummosis is believed to be a condition of weak and injured trees, but is in fact part of the plant's defence mechanism and an attempt to seal off or prevent infection. It is common with *Phytophthora* bark and collar rot and with *Diplodia* infections. Citrus gum is water soluble and disappears after heavy rains.

Dieback

Twig dieback can be caused by fungi, although non-pathogenic factors may play a more important role.

Fungal infection is often secondary, following freeze damage or damage resulting from mechanical or chemical injury. Other factors that can damage twigs are excessive fertilisation, moisture stress, damage to the root system by cultural practices, heavy red scale infestation, or heavy nematode damage.

Common Citrus Diseases

At the end of this section is a table that contains information on the most common diseases in citrus nurseries, with photographs and descriptions of the symptoms of and damage caused by each disease, and details on the commonly used control measures.

Citrus diseases that occur in nurseries are classified in the table in the following categories:

- Soil-borne diseases
- Graft-transmissible diseases

practical

Activity 6.3 – Workplace Interview

Interview your superior in the nursery to find answers to the following:

- ✓ What are the five most common pests in a citrus nursery?
- ✓ What are the three most common diseases in a citrus nursery?
- ✓ What can nursery workers do to prevent the outbreak of citrus pests and diseases?

summary

Common Citrus Diseases

- Diseases are detected through the presence of their symptoms.
- Diseases are caused by micro-organisms, such as bacteria, viruses and fungi.
- Fungi grow on the plant parts and are more likely to occur in humid conditions.
- Viral diseases destroy their host and prevention is the only means of control.
- Bacterial diseases spread very rapidly and are very difficult to control.
- The most common disease symptoms are wilting, discolouration, gum formation and dieback of plant parts.
- Citrus diseases are classified as fruit and foliar diseases, soil-borne diseases, and graft-transmissible diseases.