# Safe Handling of Agrochemicals

## Module 3:
## Agrochemical Application Principles

Learner Guide



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# Introduction

Agrochemicals in citrus are used for a variety of purposes, including plant protection, plant nutrition, and plant manipulation. Depending on the purpose, agrochemicals can be applied to specific parts of the tree itself, to the soil and to the water. In this module we look at how to apply agrochemicals safely and effectively.

# Application Methods

There are three ways in which agrochemicals are applied. These are foliar applications, trunk applications and soil applications.

## Foliar Applications

Foliar applications are where agrochemicals are sprayed onto the leaves of trees. This is the most common way for applying agrochemicals. There are four main types of foliar sprays, namely:

- Outside cover sprays
- Medium cover sprays
- Full cover sprays and
- Bait sprays

Outside cover sprays are applied at low volume and with a light covering of the tree canopy. Droplet size is small, and the tree is sprayed with a fine mist of spray material that only covers the outer canopy of the tree. The volume of spray material applied per tree varies depending on tree size and shape, but ranges from a half litre to ten litres per tree.

Medium cover sprays wet the foliage of the tree to the point of run-off, meaning that all leaves of the tree are wet but very little spray material drops off the leaves. The tree canopy is not necessarily penetrated, but some of the branches may be slightly wet, especially the green branches that bear the leaves. The volume of spray material applied per tree during a medium cover spray also varies depending on tree size and shape, but ranges from ten to twenty litres per tree.

Full cover sprays are designed to thoroughly wet the tree canopy and to penetrate the inside of the canopy, drenching the branches and framework of the tree as well. The volume of spray material applied per tree during a full cover spray ranges from twenty to fifty litres per tree, depending on tree size and shape.

Bait sprays are commonly used for the control of fruit fly. These applications require a spray with coarse, large droplet size. Sprays are often applied to only a portion of the orchard, depending on the intensity of the pest threat. The volume of spray material applied per tree varies from a hundred to eight hundred millilitres per tree, depending on tree size.

## Trunk Applications

Some agrochemicals are applied directly to the trunk of the citrus tree. These agrochemicals are systemic, meaning that they are absorbed through the bark and translocated within the tree to the area where they are required.

These agrochemicals have clear application instructions on their labels, which you need to follow carefully. In many cases they require very precise measuring, and specialised equipment that can measure the volume very precisely is normally used.

### Soil Applications

The type of agrochemical that is most often applied to the soil is granular fertilisers. They are applied to the soil by hand, and scattered a specific volume of the fertiliser around the tree trunk and over the irrigated area under the tree.

Plant protection products can also be applied to the soil, by way of a soil drench. This involves diluting the agrochemical in water and then pouring it onto the soil around the trunk of the tree. From here it is absorbed by the roots and translocated within the tree. These agrochemicals are also systemic.

Certain agrochemicals – mostly fertilisers – are applied to the soil through the irrigation system. Fertigation is the method of applying fertilisers through the irrigation system. These systems are usually automated.

## Mixing Agrochemicals

Before you can start applying agrochemicals, you have to mix them to the right concentration. It is mostly for foliar applications that agrochemicals need to be mixed beforehand. Instructions for the concentrations of particular applications can be found on the plant protection plan.

### Measuring Equipment

It is important to accurately measure the amount of agrochemicals used in an application.

For liquid agrochemicals, measuring cups that are clearly marked on the sides are used. To avoid unwanted chemical reactions, it is good practice to use separate containers for each agrochemical that you are working with. The measuring cup must also be big enough to contain the total volume that you need to measure.

Scales are used for granular chemicals that are measured by weight. Electronic scales are the best because they are accurate and easy to use, but any scale will do as long as it is accurate. Scales should be calibrated regularly by the agrochemical stores manager, and at least once a year by a professional company. The containers used on the scales must be kept clean and residue free.

### Pre-Mixing

Pre-mixing is where an agrochemical has to be mixed with water before being added to the spray tank. For this we need a bucket large enough to contain the volumes of agrochemicals and water we need to mix, and a metal stirrer.

### Calculations

The dosage instructions for the concentration to be used for an application are normally in millilitres or grams per 100 litres of clean water. To determine how much chemical is needed per spray cart, you need to know the volume of the spray tank. For this exercise we will work on a volume of 500 litres.

Let's say the dosage instruction is for 100 millilitres per 100 litres of water. Divide the volume of the spray tank – in this case 500 litres – by the volume in the instructions – in this case 100 litres. This gives us five, meaning there is five times more water in the spray tank than what our instruction is for. If we multiply the dosage in our instruction by this factor, we will know how much of the agrochemical we need to the volume of water in the tank. In this case, we will need 500 millilitres of the agrochemical in the 500 litre spray tank to get the correct concentration.

In some cases, you will need to mix more than one agrochemical in the same spray tank. The volume for each agrochemical must be determined on its own with a separate calculation. The same method is used if we need to add spray oils to the mixture.

## Mixing

Once you have collected the agrochemicals from the storeroom, inspect and identify the chemicals, check their expiry dates, and ensure that you are aware of the toxicity of agrochemicals and safety instructions for handling them. Put on the necessary protective clothing and gear. Clean water and soap must be available so that you can immediately wash if an agrochemical comes into contact with skin, and so that you can wash after handling the agrochemicals. After you have identified the volumes of the agrochemicals that you need, do as follows:

- Accurately measure the agrochemical, using the appropriate equipment.
- Fill the spray tank halfway with clean water. Run the water into the spray tank through a course filter to make sure there are no particles in the water that can block the spray heads.
- If the product label indicates that premixing is required, add the measured volume of agrochemical to 10 litres of clean water in a bucket and mix thoroughly with the metal stirrer. Add the mixture to a spray tank half full of water.
- If premixing is not required, add the measured volume of agrochemical directly to the half-full spray tank.
- Fill up the spray tank, stirring – also called "agitating" – the mixture all the time.

# Calibration of Application Equipment

To ensure that the right amount of spray material is applied to the crop, the spray equipment must be calibrated. Carefully follow the calibration instructions for the equipment that you use. Incorrect calibration can result in the agrochemical application being ineffective if not enough of the product is applied to the crop, and if too much is applied, it can damage the crop. Over-application can also poison people, animals and the environment. It is also a waste of money. Check equipment thoroughly before use. Do not use faulty equipment, but report it as soon as you are aware of it.

For trunk applications and soil drenches, plant protection products are measured and equipment calibration is therefore not normally needed. The exception is for where special applicators are used for trunk applications of when a Calibra applicator is used. In this case the Calibra must be calibrated or set at the correct volume required for the trunk size, according to the formula given on the label. When foliar applications are used, the spray equipment must, however, be calibrated to ensure that the correct volume of spray material is delivered. As there is a wide variety of mist blowers in use, follow the procedures recommended for the mist blowers you use for calibration.

# Cleaning Equipment

After mixing the chemicals all equipment must be thoroughly cleaned and dried. Chemical residue left in containers used for mixing can cause unwanted chemical reactions if used without proper cleaning. As discussed in a previous module we must also ensure that all safety clothing and equipment are cleaned and stored away neatly after each day's work. Chemical containers that were used but that are not empty must be taken back to the storeroom and replaced in the correct places.

# Recordkeeping

Recordkeeping is an important and often neglected facet of managing agrochemical use, as chemicals are issued from the store and mixed records must be kept of the quantity used and in which orchard and block the chemicals were applied. Recordkeeping can help us keep track of what application was done to certain blocks and let us work out if our measurements were accurate or not. Soil samples should be taken at least annually by an accredited lab to assess chemical load of the soil and the residue levels of all crop protection and crop production products Recordkeeping also forms an important part of all certifications systems such as Global GAP and others.

# Conclusion

It is important that we as producers and workers take the responsibility of using agrochemicals safely and effectively. Using agrochemicals as directed can save the production facility money. More than this, using the chemicals safely and storing them as directed can make sure that we get full value out of these products.