Citrus Plant Propagation

Module 2:
Citrus Propagation Methods

Learner Guide

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Citrus Growers' Association OF SOUTHERN AFRICA
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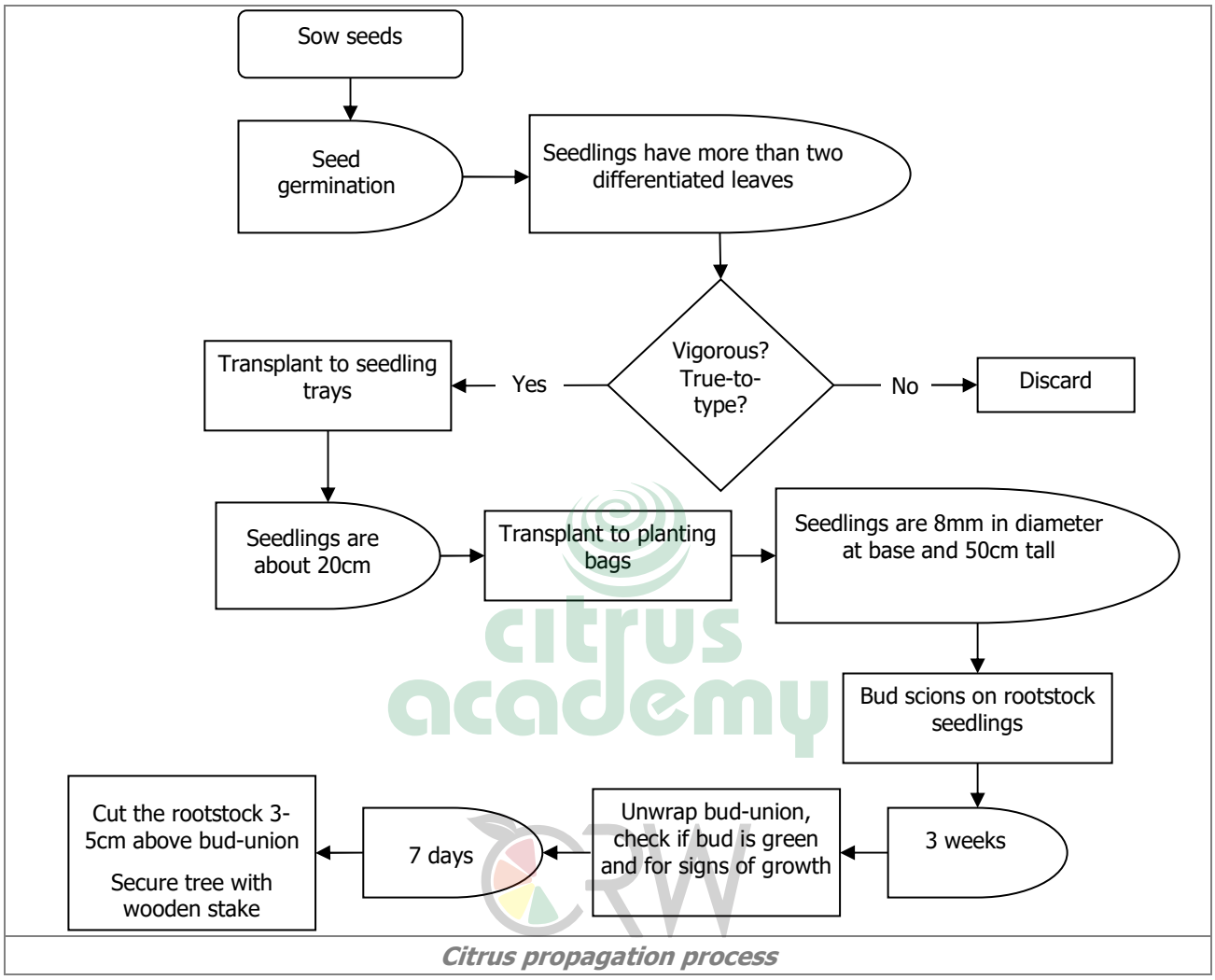
Introduction

In this module we take a detailed look at the process of growing a new citrus tree. You will be familiar with this diagram from the first module.



Citrus propagation process

In short, seed is sown in germination trays. Once they have germinated the seedlings are transplanted to seedling trays, from where they are transplanted to planting bags as soon as they are big enough. A bud of the required fruit variety is budded or grafted onto the rootstock seedlings. The rootstock plant is cut back and the bud grows out to form the fruit-bearing part of the tree. Around eighteen months later, the tree is ready to be delivered to the farm for planting. Let's look at each of these steps in detail.

But before we do that, please make sure that you have a thorough understanding of citrus rootstocks, cultivars and varieties. To refresh your memory, please watch the Citrus Types and Cultivars module that is part of the Citrus Planting Management series.

Rootstock Sowing

We start by sowing seeds in germination trays and placing them in a germination room. Seeds must be from a reputable supplier, where they are sterilised, treated with fungicides and dried before being packed and sent to the nursery. Here they must be stored in a refrigerator at about 10°C until they are used.

In preparation for sowing, put the seeds in water in a bucket for about 30 minutes. This allows the seed to imbibe water and for the seed coat to swell, which kick starts germination. In the meantime, fill the germination trays about halfway with vermiculite, level it out and stamp it down. When the seeds are ready, pour them in an even layer over the vermiculite, covering the entire tray. Stamp the layer of seeds down evenly. Fill the trays with vermiculite, even it out and stamp it down. Water the trays well before moving them into the germination rooms and placing them on the metal racks.

In the first module we described the ideal environmental conditions for seed germination. It is important that the temperature, humidity levels and light in the rooms must be controlled and monitored. The seeds must also be watered regularly and treated with fungicides – remember that the hot and humid conditions in these rooms are ideal for fungal growth. Seeds are kept in the germination room until they have developed at least two differentiated leaves.

Transplanting Seedlings to Seedling Trays

The next step is to transplant seedlings into seedlings trays. Not all seedlings are transplanted, and seedling selection at this point is very important. Remember that growing each plant from here on becomes increasingly expensive, so the sooner we can remove and eliminate trees that are not true-to-type or that will not grow healthy and strong, the more we will save. On the other hand, we don't want to discard seedlings that are true-to-type and viable, because then we will lose the effort that we already put into the germination process.

Citrus seeds occasionally produce more than one seedling per seed, and one of those will not be true-to-type. This is a characteristic that is rarely found in the plant kingdom. To understand how it works, please watch the section on citrus seeds in the Citrus Plant Structures and Functions audio-visual series.

It means, however, that you will find a number of off-type seedlings, and it is important that they are discarded at this point. They are fairly easy to spot – their leaves are usually different from those of true-to-type seedlings, and they tend to be either a lot bigger or a lot smaller than true-to-type seedlings. You also need to look out for and discard seedlings that have bent roots and that are etiolated. They will never grow well and are best discarded at this point.

In preparation for planting, empty and wash the seedling trays if they still contain plant rests and soil. Sterilise the seedling trays, either by using a sterilisation solution or by using a steam steriliser, which is preferable. Sterilise the medium in a steam steriliser, a process that usually takes about twelve to 24 hours, depending on the system you have installed. Fill the individual cavities in the seedling trays with sterilised medium. Make a hole in the growth medium and push the seedling in slightly deeper than necessary. Pull the seedling out slightly to make sure that its roots are straight. Water the transplanted seedlings well.

While they are in the seedlings trays, the seedlings will need to be watered, fertilised, and kept free of pests, diseases and weeds. Generally fertigation is used in the nursery to apply fertiliser, because applications can be controlled accurately. The seedlings are irrigated either with hand sprayers or through an overhead irrigation system, depending on the size of the plants. From time to time individual seedlings in their cavities are moved between trays, to make up trays of seedlings that are uniform in size. Trays with seedlings of similar size are also placed together in the greenhouse, so that it is easy to see which seedlings are due to be transplanted next. At the same time, seedlings that are off-type and weak are discarded. You can spot off-type seedlings by their leaves.

Transplanting Seedlings to Planting Bags

When the seedlings reach a height of about 20cm they are transplanted to planting bags, where they will stay until they go to the orchard.

The first step is to prepare the planting bags. Depending on the type of propagation medium you use, you need to prepare and sterilise it as indicated. Planting bags are filled to the top with the medium. Don't stamp it down; it is important that the medium must stay aerated and loose so that the roots can penetrate it as they grow. The filled bags are packed into crates, which are moved into the greenhouse or shade house. Line up the crates with the filled planting bags, and water them well with a hand sprayer. It is important that the medium must be wet through before the seedling is planted in it. Make a dibber by using a cavity from a seedling tray and attaching it to a stick. This is a good way to make sure that the holes are exactly the right size.

A tray of uniform seedlings that are all true-to-type and vigorous should be easy to identify for transplanting, if seedling selection and grouping have been done regularly in the greenhouse. Make sure that the growth medium around the roots is moist. Carefully remove the seedling from the cavity with the growth medium still around the roots. If the seedling sticks in the cavity, tap the cavity on the outside.

Put the seedling into the cavity in the planting bag. Don't plant the seedling too deep, the seedling's growth medium must still be visible on the surface of the growth medium in the bag after it has been planted. The seedlings are kept in greenhouses, but they can be moved to shade houses when they are a little bigger. They must also be kept irrigated, fertilised and free of pests, diseases and weeds.

Budding

When the rootstock seedling is about 50cm in height and about 8mm in diameter at its base, a scion of the cultivar that we want the fruit to be is grafted onto the rootstock seedling. This involves taking a bud-eye from a stick of bud-wood and inserting the bud-eye under the bark on the stem of the rootstock seedling. The bud-eye is also called the scion.

It is important to understand why we need to use grafting in citrus propagation. Essentially, it is because after many years of research we have a very good understanding of what sort of citrus trees grow best in particular soils and climatic conditions. We also have a good idea of what sort of fruit is the best to eat. The challenge is that these are rarely the same plants. In order to benefit from the strong growth characteristics of some types of plants, and the excellent fruit quality of others, we use grafting – or budding – to combine two different plants. In this regard, it is also important to know that not all rootstocks are compatible with all fruit varieties. It is important to make sure that you understand and know what rootstock to combine with your desired fruit variety.

At the Citrus Foundation Block near Uitenhage in the Eastern Cape trees of every citrus variety are grown. Bud-wood is cut from these trees and shipped to nurseries all over the country. This is a central part of the Citrus Improvement Scheme. In some cases, however, the Citrus Improvement Scheme may authorise nurseries to cut bud-wood for their own use if they have their own variety blocks. This may, however, only be done with authorisation and under strictly controlled circumstances.

In preparation for budding, get your budding knife, tape and bud-wood ready. Sterilise the budding knife in a sterilisation solution. People normally work in teams of two for budding, with one person doing the budding and one person applying the tape to wrap the bud-union.

Budding is done as follows:

- Make an inverted T-cut into the bark of the stem of the rootstock.
- Cut a bud-eye evenly and smoothly from the bud-wood stick.
- Slide the upper end of the bud-eye underneath the bark flaps at the bottom of the inverted T-cut.
- Wrap the bud-union with tape to hold the bud in place and to give the wound a chance to heal.

The tape also prevents water from entering the wound and protects it against infection. The tape is applied from below the incision in overlapping turns around the stem until the entire bud and incision are covered. Tie the ends of the tape to keep it in place.

Remember to sterilise the budding knife often, especially when you change the fruit variety that you are budding.

Post-Budding Process

After three weeks the tape is cut on the opposite side of the stem from the bud-union, and removed. If the bud is green and growing, the budding has been successful. If the bud is brown and dead-looking, the budding was not successful, in which case the seedling is set aside for re-budding.

After another seven days the scion should be growing actively. At this time the rootstock seedling is cut off 3cm to 5cm above the bud-union, so that growth energy is directed into the bud. This is done with pruning shears, which have been sterilised with a sterilisation solution. As soon as the first flush has grown and hardened off on the bud, the 3cm to 5cm stub is cut off just above the bud-union.

Side shoots are also removed from the rootstock part of the plant, so that growth energy is not wasted.

Staking

Once the stub has been cut off just above the bud-union the tree is staked. A wooden stake or cleat is planted next to it, to which it is tied. The cleats must be treated with copper at the end that is planted in the soil, to ensure that it is free of soil-borne diseases and to slow down the rotting of the part of the cleat that is in the soil.

Topping

When the plant reaches pencil-thickness at the top of the stake, it is topped to encourage the main stem to thicken and the fruit-bearing part to grow side branches. The timing of this varies between cultivars, and can be anything from twelve to fourteen months.

Nursery Practices

Irrigation

Nurseries make use of a variety of irrigation methods and systems, depending on the size of the plants and the nature of the structure in which the plants are kept.

Small seedlings are mostly watered by hand, with hand-held hoses. In greenhouses, smaller seedlings can also be watered with overhead irrigation system, which are sometimes called rain-replacement systems. Once the seedlings are in planting bags there is enough space to install drip irrigation, which allows for a much greater level of control in the amount of water that is delivered to each plant. Drip irrigation is used until the plants are ready to be shipped.

Fertilisation

Plants are fertilised mostly through using fertigation. Automated fertigation systems can be expensive, but they are worth the investment because it allows the manager to accurately control the amount of fertiliser that is applied to each plant. Fertilisation mixes and application rates are normally based on recommendations by plant nutrition experts.

Pest and Disease Control

It is important to scout regularly in the nursery for pests that attack citrus plants and for disease symptoms, by manually inspecting plants and by using pest traps. A preventative spray programme is also usually implemented. Plant protection products can be applied with knapsack sprayers or with spray machines in shade houses that are big enough to accommodate them.

Weed Control

All plants that compete with citrus trees for food and water in the nursery are weeds, and they have to be eliminated. Weed control products are normally applied with knapsack sprayers.

Recordkeeping

Recordkeeping is an important part of nursery management. It is also essential for certification under the Citrus Improvement Scheme. In a large nursery there can be hundreds of thousands of trees in the nursery at a given time, of all ages and at different points in the propagation cycle. The nursery must have a system in place that carefully keeps track of all the trees in the nursery.

It is a good idea to keep trees of the same age and in the same stage together in groups of a certain size, for instance 1,000. Each group can then be given some unique name, which will allow you to keep track of the groups. If all groups have the same number of trees in them – in our example 1,000 – it is also easier to count the trees in a particular place. It is important to have some form of signage attached to each group and even to the individual trees, which shows the unique name of that group, along with important information about the propagation of the trees, such as the type and cultivar of the rootstock and the scion, and the dates of sowing, transplanting, budding, and so on. Your recordkeeping system can be designed to keep track of each group, in terms of where it is located in the nursery at a given time, and where in the production cycle it is.