

TECHNOGUIDE ON  
**CITRUS**  
PRODUCTION  
THROUGH VEGETATIVE PROPAGATION



# PROPAGATING CITRUS

Citrus is a group of fruit trees that produce juicy fruits with slightly sour taste. This includes citron, lemon, lime, orange, and grapefruit. Citrus trees are widely cultivated in warm countries like the Philippines for their fruit which has juicy flesh and pulpy rind.

These popular selling fruits thrive well in tropical and subtropical climates. Some of the best quality oranges are grown in the non-humid, irrigated, subtropical areas such as the Mountain Province. It can be grown in four types of climate but areas with well-distributed rainfall throughout the year are the best.

These trees can either be propagated through seeds (sexual) or vegetative (asexual) means. Seed propagation is being practiced primarily for the production of good rootstocks for budding purposes. Vegetative or asexual propagation, on the other hand, is done either to preserve the desirable characteristics of a particular plant; to propagate plants that do not produce viable seeds; to propagate plants that produce seeds that are difficult to germinate, and to bypass or avoid the young/adolescent stage of plant growth, among others.

Generally, propagators use budding, grafting, and/or cutting as techniques in propagating plants asexually. Budding and grafting are vegetative propagation techniques wherein a single bud or stem (scion) of a desired plant (cultivar) is attached to a rootstock plant. In budding, a single bud with its accompanying bark (budwood) is used as a scion while in grafting, part of a stem or branch is used as a scion.



# METHODS OF PROPAGATION

The major methods of asexual propagation are cuttings, layering, division, budding and grafting. Cuttings involve rooting a severed piece of the parent plant; layering involves rooting a part of the parent and then severing it; and budding and grafting is joining two plant parts from different varieties.

## 1. BUDDING

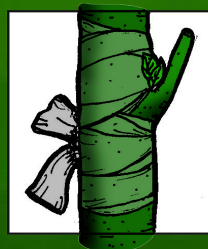
It is the standard method used in propagating citrus. Aside from being the easiest method, it also allows a large number of plants to be propagated from a small amount of scion wood and is suitable for trees, rootstocks, or branches from  $\frac{1}{4}$  to one inch (0.6 to 2.5 cm) in diameter.

### Advantages:

- very small amount of scion material is needed
- requires low level of expertise
- know within 2 weeks if budding is successful
- can provide size regulation and pest resistance

### Disadvantages:

- requires rootstock, supplies
- can only be done at certain times of year



Budded plant

Grafted  
plant



## 2. GRAFTING

Grafting has long been used to produce novel varieties of roses, citrus species, and other plants. It is the production of plants by combining the favorable stem characteristics (scion) with the favorable root characteristics (stock).

### Advantages:

- can provide size regulation and pest resistance
- larger piece of scion is easier to handle

### Disadvantages:

- uses a lot of scion material
- requires rootstock, supplies
- requires higher level of expertise
- can only be done at certain times of year

## Primary conditions to ensure that grafting will be successful:

### 1. Compatibility

Ensure that the plants for grafting are of the same genus (one or more species of plants that are closely related to each other).

### 2. Cambial contact

This is done by properly positioning the scion on the rootstock. In order for the scion and rootstock to grow together, the greenish plant layer (cambium) located just under the barks must be aligned so that they touch each other. Having no contact with each other means that the bud or graft failed.

A successful bud or graft forms a hard whitish tissue (callus) to where the two cambium layers

grow together in 10 to 15 days.

### 3. CUTTING

Cutting is the most commonly used method/technique of vegetative propagation. This is done through cutting the plant stem including a tip (e.g. shoot, twig, sucker) or a portion of a stem without the apex that includes one or more nodes removed from the parent plant and is capable of rooting.

Cutting is used to grow a whole new plant which is also known as cloning as you are trying to create an exact copy of the parent plant, referred to as the clone.

#### Advantages:

- usually easy to do and does not require extra materials
- can be done most of the year

#### Disadvantages:

- use of many scion materials and that varieties may be susceptible to soil pathogens
- no size regulation of the resulting tree





## Tips in propagating plants through vegetative means:

1. Select the grafting materials (rootstock and scion) properly. Only use high producing and disease-free plants as grafting materials.

Proper selection of the rootstock is very important as it contributes to the vigour, productivity and quality of fruits to be produced. It also influences the resistance and tolerance of the trees to certain diseases and pests among others.

Improper selection of bud wood or scion may result to spread of pests and diseases.

### SELECTION OF BUDWOOD/ SCION:

- from healthy, fruiting tree
- cut budstick from hardened growth of last flush or, cut budstick from next to last flush
- round twigs are easier to handle than angular twigs
- budwood may be refrigerated for weeks to months if sanitized

### SELECTION OF ROOTSTOCK:

- rootstock must be compatible with scion
- consider ultimate size of tree desired
- consider soil conditions, insects, diseases
- pencil-thickness rootstock is the best
- bark must be slipping

2. Always use a sharp cutting or grafting instruments (single-sized razor blade, kitchen knife, budding knife) that could make clean, even cuts.

3. Do not allow the cut surfaces of the scion or rootstock to dry out. Immense cut scions in a pail of water, wrap them in plastic, or graft them immediately after cutting.

4. Remove any leaves from scions after cutting to help keep the scions from losing water. Keep the scions in a cool dry place during the work.

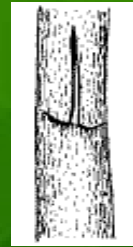
# PROPAGATING CITRUS THROUGH BUDDING AND GRAFTING

## A. SHIELD OR T-BUDDING

T-budding is generally the best budding method for citrus and avocados. This method of propagation aims to utilize the vigorous root system of the rootstock and combining the best characters of both the rootstock and the scion. Budding should be preferably done as low as possible on the rootstock.

### STEPS:

**1** To make a T-bud, make a T-shaped cut on the rootstock about 8-12 inches (20-30 cm) above the ground. The vertical part of the T should be about one (1) inch (2.5 cm) long and horizontal part about 1/3 of the distance around the rootstock. Twist the knife gently to open flaps of the bark. Avoid cutting through any buds on the bark of the rootstock.



Step 1

An inverted “T” incision is made through the bark on the rootstock stem several inches above the soil line.

**2** On the scion, cut a selected bud beginning about 1/2 inch (1.2 cm) below the bud and ending about 3/4 to one (1) inch (1.9 – 2.5 cm) beyond the bud. Make a horizontal bud down through the bark and into the wood. Gently remove the shield-shaped piece for budding.



Step 2

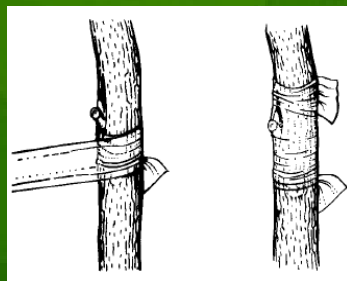
A smooth, continuous cut removes a bud and a thin sliver of wood which is used in T-budding.

**3** Slip the budwood down into the T-shaped cut under the two flaps of bark until the horizontal cuts of the bud match up with the horizontal cut of the “T”. The bud is slipped under the bark flaps created by making the “T” incision on the rootstock.



Step 3

**4** After inserting the budwood into the rootstock, wrap the graft with budding tape or rubber making two or three rounds below the bud and two or three rounds above. If budding tape or rubber is unavailable, use wide rubber bands, green tie tape or stretchy tapes. Wraps should be removed not later than 30 days after the graft. A green, healthy looking bud will indicate that the graft has succeeded.



Step 4

Begin wrapping below the bud, overlapping the tape with each revolution. Tie the tape securely after several revolutions above the bud.

**5** After the bud has healed, unwrap it and cut off the remaining shoots or stock about 12-14 inches (30-35 cm) above the bud union. This will be the nurse branch which will help protect the new bud union.

Completely remove the nurse branch to about 1/8 inch (3 mm) above the bud union after the budwood has grown a few new leaves.



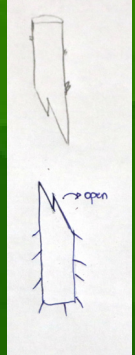
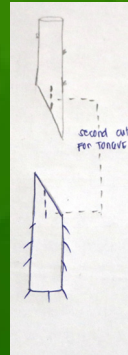
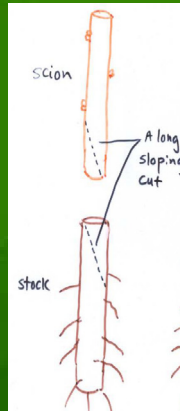
## B. WHIP OR TONGUE GRAFTING

Whip grafting is the best grafting technique for small-diameter ( $\frac{1}{4}$  to  $\frac{1}{2}$  inch or 0.6 to 1.2 cm) rootstocks. Although whip grafts use more scion wood than in budding, it allows the grafted plant to develop more rapidly. In summary, it is a graft prepared by cutting both the scion and the rootstock in a sloping direction and slipping them together through a tie and wax.

### STEPS:

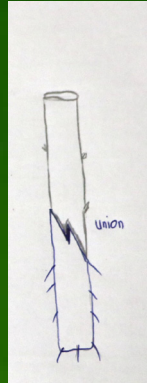
**1** Select a hard and mature green wood as the scion. Make a long, sloping cut about one (1) to 2  $\frac{1}{2}$  inches (2.5 to 6.2 cm) long on the rootstock. Then make a matching cut on the scion. Cut a 'tongue' on both the scion and rootstock by slicing downward (sloping direction) into the wood. The tongues should allow the rootstock and scion to lock together.

**2** Fit the scion and the rootstock together and secure it with a budding rubber or tape. Apply grafting wax to seal the union. To prevent sunburn, new whip grafts should be protected from the sun until they heal.



3 The scion and the graft union can also be covered with a transparent plastic wrapper to conserve moisture and prevent it from drying up. The wrapper can be removed when there are already buds sprouting.

4 After the scion has begun to grow, remove any growth support from the rootstock. If necessary, support new shoots by staking.



## C. BARK GRAFTING

Bark grafting is the best grafting technique for large-diameter trees or branches.

### STEPS:

1 To make the bark graft, cut off first the rootstock just above a crotch (angle formed by the junction of two branches) where smaller branches sprout out. Retain one branch of the original plant to serve as a nurse branch/limb that will provide the scion nutrition and serve as support from wind.



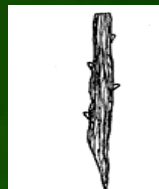
Step 1

2 Cut vertical slits of 2 ½ to 3 ½ inches (6.2 to 8.7 cm) long through the bark of the remaining freshly cut rootstock stubs down to the wood. These slits should be spaced 3 to 5 inches (7.5 to 12.5 cm) apart.



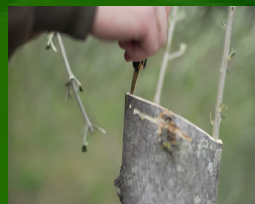
Step 2

**3** Cut the desired scions at 5 to 6 inches (12.5 to 15 cm) long with 4-6 buds per scion. To cut the scions, make a sloping cut of about 3 inches (7.5 cm) long at the base. Make sure that the cut is flat and straight in order to maximize contact with the rootstock later on.



Step 3

**4** Using a grafting or sharp knife, lift the bark on one side of the slit. Insert the scion into the slit (layer where the bark and wood would separate) with the long-cut surface of the scion facing the wood of the rootstock and push it down into the slit.



Step 4

Make sure that the scion fit tightly into the slits in the bark so that the cambiums are properly aligned. Be careful not to damage the bark of the rootstock as it helps in keeping the scion from drying out.

**5** Secure the scions by nailing them in place with thin flathead nails or tying them with strong cord or tree tape.

**6** Multiple scions can be inserted every two inches apart within the rootstock circumference. Inserting multiple scion will allow the stock to heal faster.



Step 6

**7** Coat all cut surfaces thoroughly, including the tops of the scions, with heavy wax or tar-based wound dressing to prevent drying and the early introduction of wood rots.



Step 7

This may take two or three coats applied starting as soon as the scion wood placement is completed, and continuing over the next day or two. Paint is not an acceptable substitute.

## CARING AFTER GRAFTING

**8** Inspect the grafts frequently and rewrap them if they begin to crack or dry out. Prune the scions that will be removed to reduce their vigor and make should to not prune the scions that will be kept.

**9** Cut off new shoots from the nurse limbs as these compete with the growing scion especially in terms of nutrient absorption.

**10** Once the scions begin to grow well, select and retain at least two best scions in the stock to let the graft heal faster. The other scion you keep will eventually become a main scaffold branch.

**11** Remove the nurse branch/limb after all the scions are growing well and became established.

**12** Put temporary stakes as support to the growing scions.

## D. CLEFT GRAFTING

It is one of the oldest and most widely used type of grafting. It is used to change over (rework) an established fruit (scion) variety to a new (more desirable) variety, or to obtain multiple varieties on a single tree, or to insert a pollinizer branch for self-incompatible trees like apple. Cleft grafting is used for grafting one or smaller diameter scions (5 to 10 mm) onto a larger stock (5 cm or greater). It is useful with both large and small plant materials.

### STEPS:

**1** Choose a healthy rootstock. Cut off the shoot and make a vertical cut making a V-shaped opening for the scion.



**2** Get a scion from a selected outstanding fruit tree with stem size that is approximately matching with the rootstock material. Leave at least 2-4 nodes in the cut scion.



3 Cut the basal end of the scion into a gently sloping wedge of about 2 cm long.

4 Insert the scions in the full depth of their wedge bottoms. Two scions go in each cleft, one at each point where the cleft intersects the ring of cambium. This ring is located just inside the bark of the rootstock and scion. Try to line up the cambium layer of the scion with the bark as you insert it. Do not insert it in the center to ensure cambial contact.

5 Seal cuts from moisture loss and pathogen entry, apply melted grafting wax. Distal ends of scions should be waxed as well. For others, they wrap the graft union with thin plastic strip and cover it with any transparent plastic wrapper that matches the union.

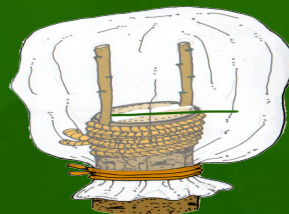
6 Follow up with general aftercare, such as humidity control, until the union fully takes. Also, at some point after your scions have grown on, choose the healthiest and truest-growing of the two scions, and eliminate the other by pruning.



Step 3



Step 4



Step 5



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*\*Some of the photos used were lifted from the internet.*

*\*This technoguide has undergone technical review by Ms. Eleanor W. Camut, Agriculturist II (High Value Crops Development Program ) and Mr. Landes B. Teofilo, Senior Science Research Specialist (Research Division) of the Department of Agriculture-RFO-CAR*

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