

# Plant Propagation, day 1: course notes

## Propagation

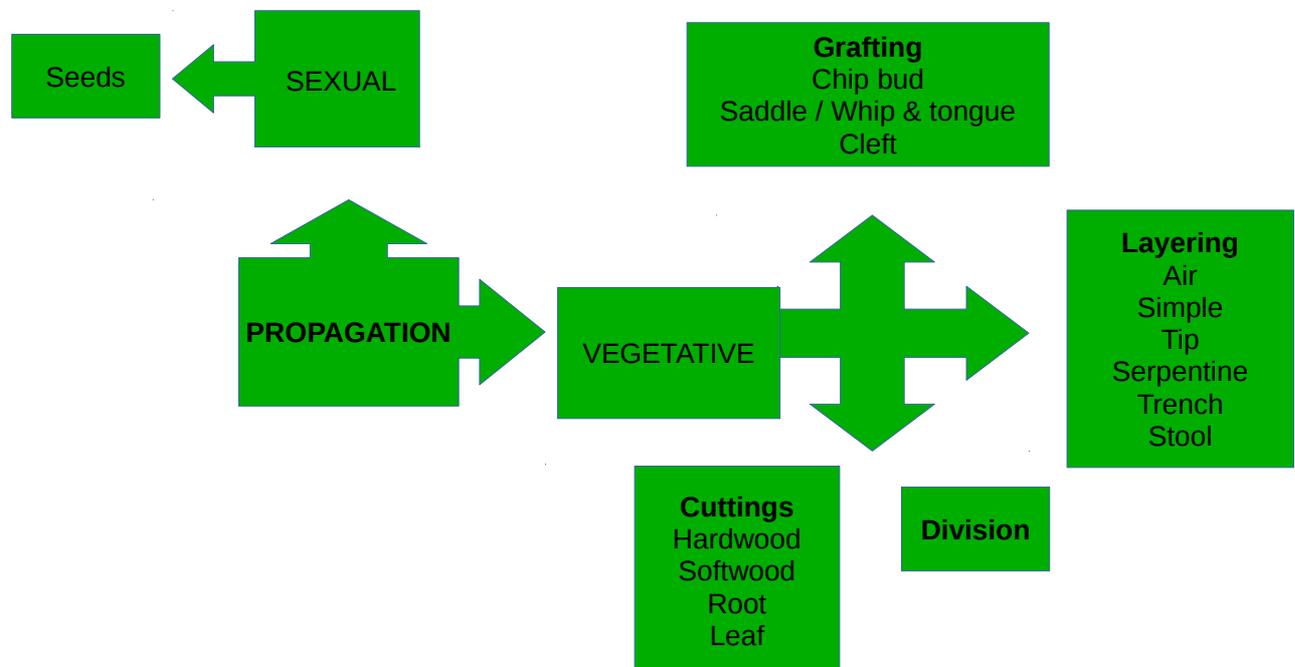
### Unit title: Developing Plant Propagation Skills

- 1.1 Describe the term 'propagation'.
- 1.2 Describe methods of propagation.
- 4.1 Describe methods of layering and grafting.
- 4.2 List plants that may be propagated by each of these techniques.
- 4.3 Demonstrate the technique of:
  - a) layering
  - b) grafting



LOTTERY FUNDED

Vegetative propagation is cloning. Different methods are suitable for different plants.



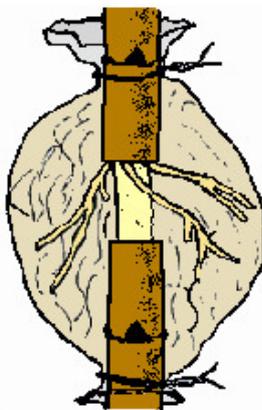
# Layering

At ELL, you can simple layer all the *Rubus* species except for Raspberries (Japanese Wineberry, Tayberry, Thornless Loganberry & Thornless Blackberry) Oregano & Sage. For serpentine layering: Grape and Hop. You can tip layer Goji, *Lycium barbarum*, most of the *Rubus* spp, *Atriplex halimus* and even Mulberry, *Morus nigra*. The following five sections are taken from [www.yourgardeninginfo.com](http://www.yourgardeninginfo.com).

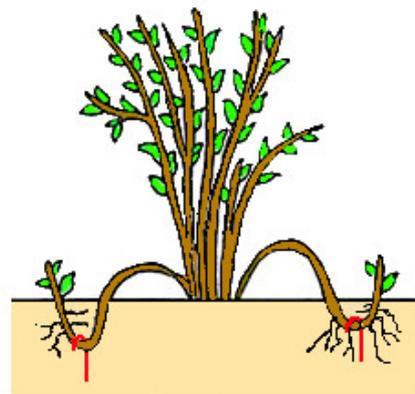
Layering is a simple propagation technique which doesn't need a propagating frame or greenhouse. Underlying principle is based on the fact that a plant that has been scraped or fractured is likely to produce roots from the wound if this portion of the plant is in contact with the soil or other rooting medium. Once roots have grown from a stem, you have the makings of a new plant, which can be detached and moved.

Layering is really suitable only for woody-stemmed plants - shrubs and trees, including some houseplants. This method often succeeds where cuttings fail. Many of the pendulous or lax-stemmed shrubs and trees, such as Willow, *Salix x chrysocoma*, layer themselves naturally when their stems touch the ground. *Rubus* spp also tip layer naturally. The constant rubbing of the branch against the ground causes an injury to the bark, and roots develop from the callous formed over the wound to anchor the branch.

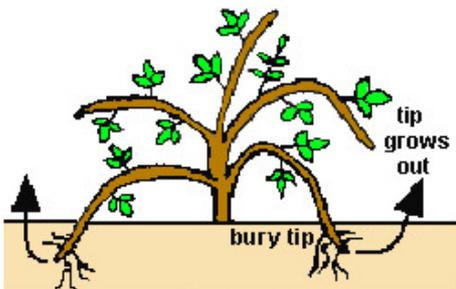
## Types of Layering



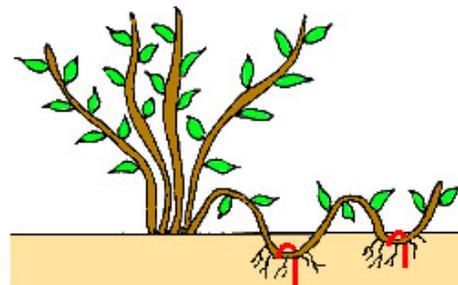
air layer



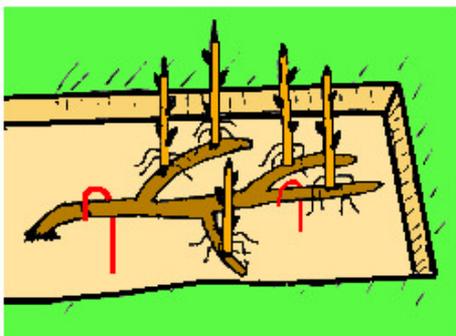
simple layer



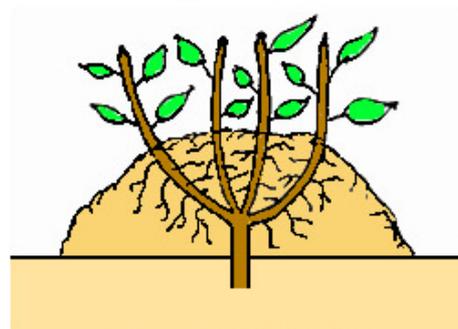
tip layer



serpentine layer



trench layer



mound or stool layer

## Simple Layering

The best branches for layering are non-flowering ones that have grown in the current year — that is, the freshest, smoothest shoots. Deciduous plants are best layered in autumn or winter; evergreens in autumn or spring.

First, fork over the surface of the soil around the plant. Choose any flexible branch and bend it down until it reaches the ground 23-30cm from the tip, held at an upright angle. Strip the leaves off the branch where it touches the soil. Wound the underside of the branch to restrict the flow of sap by cutting a shallow tongue with a knife, cutting towards the growing tip. Alternatively, twist the branch to injure the tissue. Dig a hole 7.5-10cm deep beneath the wound. Rooting hormone may encourage quicker rooting, but is not essential. Push the wounded part of the branch into the hole, forming a right-angle at the wound. Peg the branch to the ground with a bent piece of galvanized wire, 15-20cm long, and stake the upright tip. Fill the hole with compost. Repeat with other branches. Water the area thoroughly and ensure that it never dries out.

Check for the new roots by carefully scraping away the soil. Most ornamental shrubs take six to twelve months to root sufficiently. If roots are well established, sever the new plant from the parent, lift with a good ball of soil and plant elsewhere in the garden. If the roots are not well grown, but the layer is healthy, replace the soil and leave it for a few more months before re-examining the root formation.

## Tip Layering

Certain plants can be propagated simply by burying the tips of their shoots in the soil — brambles such as blackberries and loganberries are particularly successful. Towards the end of mid summer, bend down a new season's shoot and, where it touches the ground, dig a 15cm hole with a hand trowel. Plant the entire tip of the shoot in the hole and firm it in. Peg down the shoot if it is particularly springy.

By mid autumn the tips will have rooted. Sever each new plant from its parent by cutting just above a bud. Do not move the plant yet. In late autumn transfer each new cane to its permanent bed. It will bear fruit in either its second or third year.

## Serpentine Layering

A handy plant propagation technique of propagating woody plants with long pliable stems — especially climbers — is called serpentine layering. It should be done at the same time as ordinary layering. Use long, trailing shoots that have grown during the current year.

Bend a shoot to the ground carefully and, where it reaches the soil, dig a 5cm deep hole beneath it. Wound the shoot underneath as for ordinary layering. Peg the wounded part of the shoot into the hole with a piece of bent wire or a small forked twig. Fill in the hole with some compost if you have it, but the soil you dug out of the hole will suffice. Cover with garden soil and firm in with your fingers. Leave the next two pairs of leaves above ground and repeat the operation. Continue this way along the entire length of the shoot.

One year later, the serpentine layer should have rooted. Scrape the soil away from each buried section of the layer and, if it is well rooted, sever it from the preceding section with secateurs. (If it is not well rooted, bury the whole layer again and check it a few months later.) Each rooted section is now ready to be severed and planted out in the normal way.

Transplanting is made easier if, instead of pegging the shoots into holes in the ground, they are pegged into pots of compost sunk into the ground. When the layer has rooted it can then be severed and moved without disturbing the new roots.

## Growing from Runners

A runner is a type of aerial or underground stem which, when it comes into contact with moist soil, roots along the stem and forms new plants — a form of natural layering. The runners formed by healthy strawberry plants,

and other ornamental members of the genus *Fragaria*, provide an easy means of propagation. In early summer, anchor the plantlets with pegs if the plants are grown in matted rows. Let them root into the soil, removing the remainder of the runners beyond the first plant.

Alternatively, select the strongest plantlets and peg them down into pots, sunk to their rim in the soil, and potting compost. Water the pots frequently to aid root formation and remove all other runners as they form. The plantlets should be separated from the parent in mid to late summer and planted out from their pots. If, for some reason, planting is delayed until the autumn, the young strawberry plants should not be allowed to fruit the first season. Pinch out the flowers as they appear.

### Air Layering

When branches are too stiff or too high to be layered at soil level, they may be 'layered' in the air. This can be done between late spring and mid summer. Air layering is particularly recommended for *Ficus species*. This method of propagation is sometimes known as Chinese layering.

Select a stretch of the branch of the current year's growth and strip off the leaves in the middle. Then cut off a shallow slice of wood and put rooting powder on the cut. Wrap a sheet of polythene around the area of the cut and tie the bottom of it with raffia or string. Fill the open-topped tube with a mixture of equal parts moist peat, coarse sand and sphagnum moss. Fasten the top with more string or raffia.

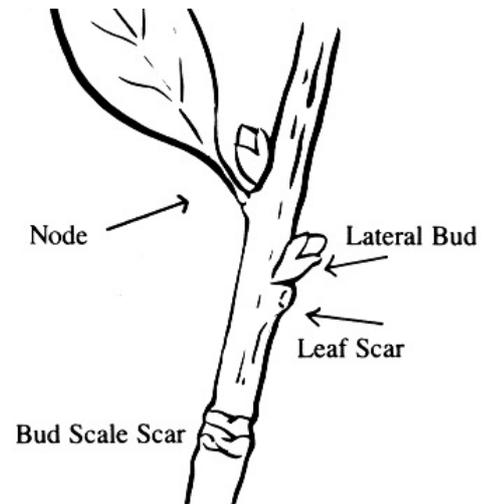
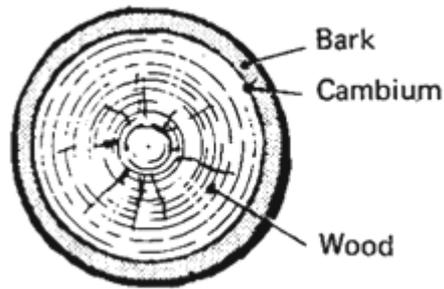
The conditions needed for rooting of the air layer are constant moisture, exclusion of sunlight and restriction of the stem. Therefore, it is necessary to use black polythene and well-moistened rooting mixture. Once the polythene is sealed, no further watering will be needed.

In three to six months, when rooted — check by unfastening the top of the polythene — remove the polythene and cut off below the roots. Pot up the new plant into a 11-15cm pot containing a potting compost. Place the potted plant in a closed frame for two weeks and keep it moist, then harden it off. This entails opening the frame during the day, gradually admitting more air until the frame is left open entirely. Plant out the following spring.

### Mound (stool) layering

Taken from <http://www.ces.ncsu.edu/hil/hil-8701.html> . This is useful with heavy-stemmed, closely branched shrubs and rootstocks of tree fruits. Cut the plant back to 5-10cm above the soil surface in the dormant season. Dormant buds will produce new shoots in the spring. Mound soil over the new shoots as they grow. Roots will develop at the bases of the young shoots. Remove the layers in the dormant season. Mound layering works well on apple rootstocks, quince, hazel and hawthorn. We use this method to propagate rootstocks.

# Grafting



## Basic (very!) botany & jargon

**Cambium** Contains the plant's vascular system, carries water and minerals from the roots to the leaves, carries food back from the leaves after photosynthesis.

**Node** Has a concentration of actively dividing cells.

**Scion** Cutting of the plant that we want to reproduce.

**Rootstock** Rooted plant that we'll graft the scion onto.

**Juvenility** Phase in which the plant cannot yet flower or fruit, but can form roots easily.

## History

Vegetative plant propagation techniques are ancient. Grafting was in use by the Chinese before 2000 BC and was widely used in ancient Greece and Rome. The development of grafting was key to the domestication of fruit trees such as apples and cherries.

## Why?

When simpler propagation methods are inappropriate or not possible. e.g. when:

- cuttings don't work
- 'top working' existing trees
- you want particular rootstock characteristics
- you want more than 1 type of plant on the same rootstock

## Which plants?

- Fruit cultivars are usually grafted to the same species, or at least the same genus.
- Compatibility is not straightforward. e.g. most pears are grown on quince rootstock, but quince cannot be grafted onto pear...
- Hawthorn is a versatile rootstock.
- Rootstocks are usually 1-2 yrs old and can be grown or bought. You can also graft onto existing trees.
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Scion / Budstick	Rootstock		
	Apple e.g. MM106	Quince	Hawthorn
Apple	♥		
Quince		♥	
Pear		♥ but many incompatible	
Loquat		♥	
Medlar	♥	♥	♥ (best)
True Service Tree		♥	♥
Exotic Hawthorn			♥

## Which type of graft for June / July?

**Chip bud grafting** is where you take the bud of the desired plant and graft it onto the stem of the rootstock plant. It's one of the easier forms of grafting. A bud, rather than a shoot, is attached to a rootstock to make a new plant. With practice, this technique can be mastered by anyone and, as just one bud is needed to make a tree, it is very efficient.

Chip budding is often used for fruit and ornamental, deciduous trees. Trees in the rose family such as apple, cherries, hawthorn, pear, plums and *Sorbus* are especially amenable to chip budding.

For chip budding, a bud on a sliver of wood, complete with bark is inserted into a matching notch on the rootstock.

Chip budding is carried out between mid-summer and early autumn.

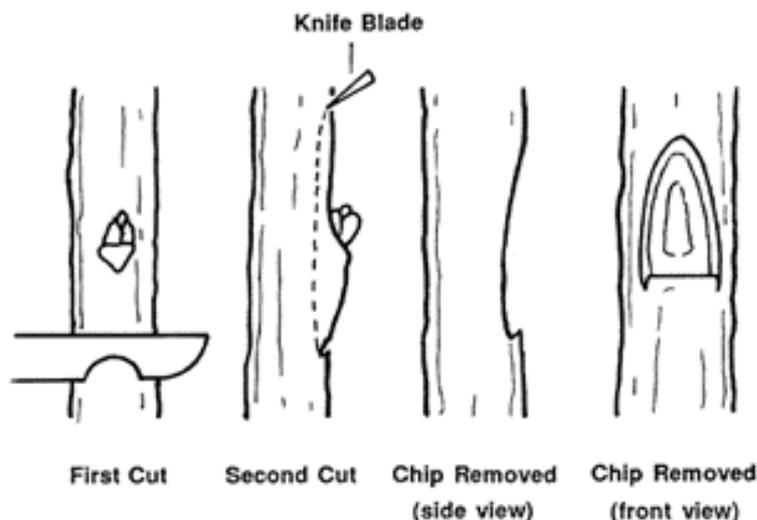
Before you start, you need to choose a rootstock (the plant you will be propagating onto). Rootstocks can often be bought from rootstock growers and nurseries that specialise in the type of plant in question. Alternatively, they can be raised from seed or cuttings.

Choose a rootstock with desirable characteristics; such as a dwarfing habit that makes fruit trees more compact, or a rootstock that resists root diseases, or one that is easier to propagate than the scion (top part of the budded tree).

From mid-summer choose the buds you wish to chip bud, by selecting non-flowering shoots that are a similar diameter to the rootstock, from well-ripened, current season's growth. Remove these 'budsticks' from the parent plant so that they can be budded onto the rootstock.

- To prepare the rootstock, cut off all shoots and leaves from the bottom 30cm of stem.
- To prepare the 'budstick', remove the soft, fleshy, tip growth and remove all leaves with knife or secateurs, leaving 3-4 mm stubs of leaf stalk.
- Using a clean, very sharp knife make a cut 2cm below a bud, inserting the blade about 5mm deep at an angle of 30 degrees.
- Make a second cut about 4cm above the first. Cut down through the wood to meet the first cut, taking care not to damage the bud.
- Then immediately make two cuts in the rootstock about 15cm from the ground to exactly correspond with those on the bud chip and remove the resulting sliver of wood.
- Place the bud chip into the 'lip' of the cut rootstock so that the cambium layers match as exactly as possible. Bind the join tightly with grafting tape, leaving the bud and leaf stalk exposed. You can also use wax or something else that will keep the join protected and immobile.
- The tape can be removed once the bud starts to swell. Insert a cane and tie in the new shoot as it develops.
- The following spring, cut back the stock just above the bud. Plant out the following winter after the bud has grown into a new tree.

Failure of buds to take usually results from not cutting accurately enough to get the cambium layers to match. Practise on spare shoots until a really good match can be reliably cut. Some less experienced gardeners like to attach several buds as at least one should take.



### Which type of grafts for March?

These grafts are done just before rootstock growth starts in the spring.

**Saddle grafting** It is appropriate when the scion and rootstock are of a similar diameter.

Matching cuts are made at the ends of the rootstock and scion. You can use a knife or a special grafting tool to do this.

Check the cambium layer is lined up before sealing the union with grafting tape.

**Cleft grafting** is appropriate where the rootstock has a larger diameter than the scion. There is a comprehensive explanation on pages 87- 88 of the CAFG textbook

**Whip and Tongue grafting** is also appropriate when the scion and rootstock are of similar diameter. It's like saddle grafting, but just uses a different cut.

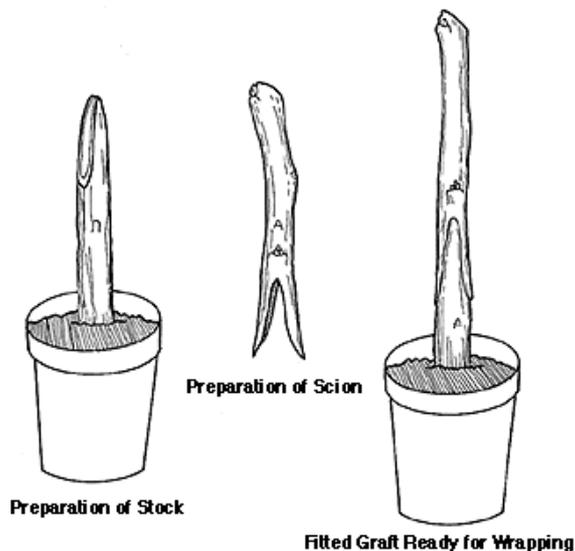
The scion is a cutting about 15cm long with a healthy-looking bud at the end.

Matching sloping cuts are made at the ends of the rootstock and scion. Check they fit together well.

A 'tongue' is cut about  $\frac{1}{3}$  down from the pointed end of each. This will lock the 2 parts firmly together, and maximise the cambial area in contact.

Grafting tape helps support the join and prevents water loss.

A successfully grafted plant will be healed and growing by summer.



### Watch out:

- **Knives are dangerous!**
- Scion wood frozen at harvest is said to be less successful.
- Keep the scion the right way up - look at the buds.
- Aligning the cambium is key to success.
- A sharp thin blade is essential.
- Clean your tools and don't touch the cut surfaces of the plants.
- Label everything.

### Tools

- 'Parafilm' grafting tape, available from [www.agroforestry.co.uk](http://www.agroforestry.co.uk)
- Sharp knife: Most people seem to favour craft knives or Opinel.
- The easiest way to sterilise your blade is with a flame. Let it cool before cutting the plant.

### What now?

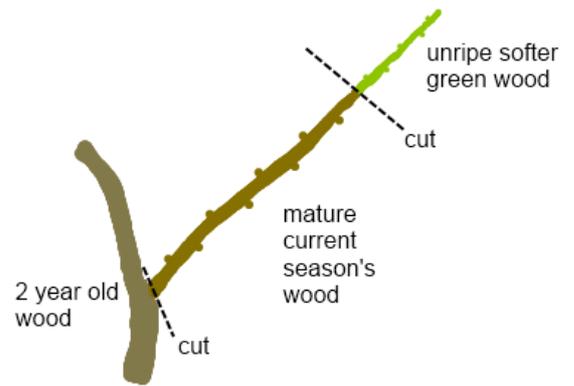
London is FULL of apple trees. There is so much ripe fruit around in early autumn that most of it goes unpicked. However from mid-October the harvest tails off. If you want to plant new trees, please don't add to the glut! Plant a different kind of fruit or choose late fruiting varieties of apple. Perhaps graft late fruiting varieties onto existing trees. That way we could have plentiful apples in London all the way to Christmas and beyond.

- Cuttings are so easy - try loads of them. Why not go home and try some grafting too?
- Got an apple tree in your garden or a hedge? - Graft some tastier fruit onto it.
- Got a favourite fruit tree? - Get some rootstock and clone it.
- *Now:* Buy your grafting tape. It doesn't go off and you want to be ready.
- *During the year:* When you taste particularly nice fruit, make a note of the tree and ask the owner if you can come back and take scions.
- *December/January:* Collect your scions in the winter and store them wrapped, in a cool place like a fridge or garage. Order your rootstocks and/or choose the trees you're going to graft onto.

# Softwood Cuttings

Adapted from [www.rhs.org.uk/advice](http://www.rhs.org.uk/advice)

Softwood cuttings are mostly used for propagating hardy and tender perennials. At ELL we propagate *Fuchsia*, Ice Plant, Fig, Jostaberry and Saltbush in this way. Softwood cuttings have the highest rooting potential of any stem cutting and often provide the best chance of rooting species that are difficult to propagate.



## When to take softwood cuttings

Most softwood cuttings are taken in spring and early summer, from the tender new growth of the season. If potted by mid-summer they will develop sufficient roots to survive the winter, otherwise pot up in the following spring.

## How to take softwood cuttings

Cuttings from young plants root more easily; heavily pruning older plants can stimulate new growth that will root quicker than the old growth.

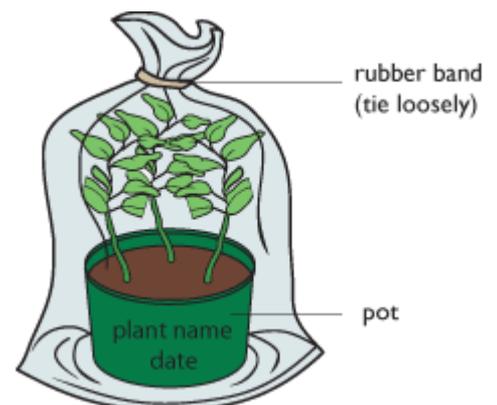
## Gathering material

- Collect material early in the day when it is full of water
- Collect non-flowering shoots, as they will root more readily
- Remove up to 10cm of shoot, cutting off the material neatly above a bud on the parent plant
- Place the cuttings material in a clean plastic bag with a label. Store the bag of material in the fridge if you cannot prepare the cuttings immediately

## Preparing cuttings

Most cuttings are *nodal*, i.e. cut at the bottom just below the leaf joint or node, where there is a concentration of natural hormones to stimulate root production.

- Using a sharp knife trim below a node to make a cutting about 5-10cm long
- Remove the lower leaves, pinch out the very soft tip – use rooting hormone if you wish
- Make a hole for the cutting in a container of cuttings compost using a clean blunt stick and insert the base of the cutting
- Label the pot and water it from above to settle the compost
- Place the pot in a closed propagator case with bottom heat of 18-24C (64-75F). Covering with a plastic bag and placing somewhere warm will suffice if no other equipment is available, but remove the bag to ventilate the cutting at least twice a week for 10 minutes. Commercial nurseries use mist units to provide constant humidity
- Cuttings should be placed in good light but not direct, scorching sunlight. Covering with fleece will help diffuse bright sunlight
- Ensure the compost is moist until the cuttings are well rooted which takes 6-10 weeks
- Once rooted, harden off the cuttings for about two weeks and pot them on individually. Covering with fleece or gradually increasing the ventilation of plastic bags or propagators will allow the soft leaves to develop a robust water-proof cuticle so that they can survive in lower humidity environments
- Remove any dead, rotting, dying or diseased material at least weekly



Some plants such as Elder (*Sambucus*), Jasmine (*Jasminus*) and Honeysuckle (*Lonicera*) can be removed from the parent plant with a heel, pulling off the stem with a 'tail' of bark from the previous season's growth.

You can also have 'basal' cuttings (from the young shoots at the base of a plant in spring) and 'greenwood' or 'semi-ripe' cuttings taken later in the year when the wood is a bit more mature.