VEGETATIVE PROPAGATION TECHNIQUES

PERRENIAL CROP SUPPORT SERIES
JALALABAD, AFGHANISTAN

Publication No. 2007-003-AFG
November 18, 2007

USAID FROM THE AMERICAN PEOPLE | AFGHANISTAN
ALTERNATIVE LIVELIHOODS PROGRAM—EASTERN REGION ALP/E

This manual was produced by Roots of Peace under USAID subcontract No. GS-10F-0359M, Task Order #306-M-00-05-00515-00, Afghanistan Alternative Livelihoods Program for the Eastern Region. It was written by Ferenc Sandor of Roots of Peace, with support from Juan Estrada of DAI for the use by Roots of Peace and Ministry of Agriculture, Irrigation and Livestock extension agents, farmers, agriculture input suppliers and other teachers. The work was funded by USAID under the Alternative Livelihoods Program, Eastern Region which is managed by Development Alternatives, Inc. (DAI). For more information, contact Roots of Peace at info@rootsofpeace.org or +1 415 455 8008.

Roots of Peace is humanitarian, not-for-profit organization based in California, USA. Roots of Peace, established in 1997, focuses on post-conflict countries to eradicate remnants of war and to re-establish and promote economic livelihoods and social programs. Roots of Peace is funded by public and private sources.

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Introduction

This manual was produced to support perennial crop development in Eastern Afghanistan. It is the first of a series of manuals that will be produced.

Vegetative Propagation Techniques
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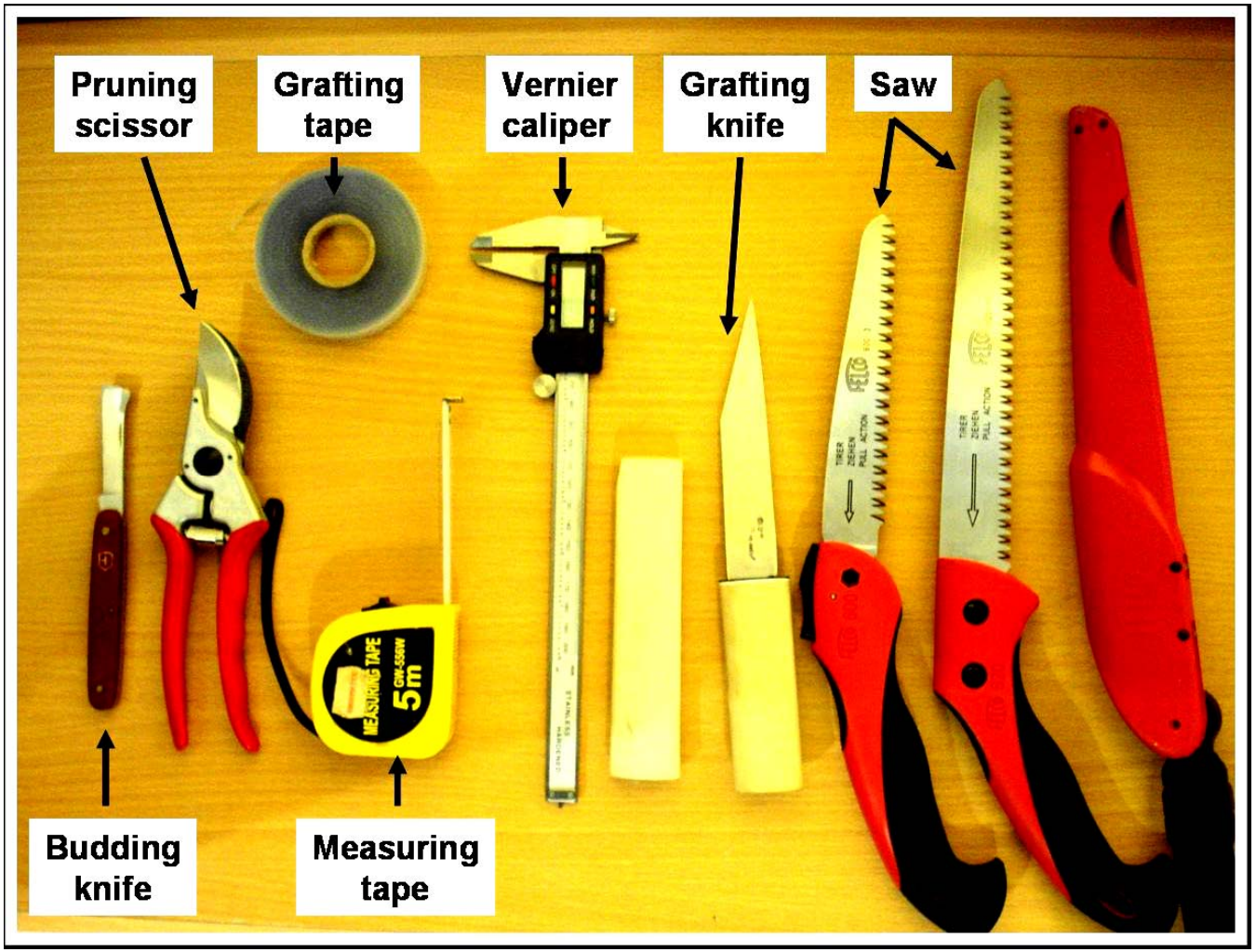
Perennial plants can be propagated in vegetative or generative ways. Fruit and nut trees are usually propagated by vegetative means using grafting methods. For this, there are two types of grafting methods: budding and grafting. Both of them are used for the same purpose - to create a new plant through the union of a suitable rootstock and an aerial part of another plant of the desired variety, called a scion. Other fruits are propagated by their own cuttings, such as stem, root and runner.

This practice of vegetative propagation of fruit trees dates back to ancient times. China had been using grafting techniques since pre-classical times. The Greeks and Romans adopted this strategy and spread these methods all over Europe.

Sexual reproduction of fruit trees is a rarely used method in horticulture. Mainly applied in research stations to conserve the richness of the gene pool and develop new varieties. On the production side, this method cannot satisfy the requirements for production quality and quantity. The new specimen, resulted from the sexual reproduction, carries unpredictable characteristics of its own, which includes the tendency to revert to a wild-like state of the specie. However, some of the known fruits keep intact their specific characteristics of the variety independently from the way, which was used for propagation. It can be sexual or asexual reproduction these fruits inherit the characteristics of the variety. The chestnut is a typical representative of this group.

Plant can be asexually reproduced either by using part of two or more plants in a union or parts of the same plant. In the first case we call it graftage and in the second case we call it rooting. All asexual propagation techniques belong one of the two categories.

Schematic 1: Fruit Propagation Tools



Source: Photograph by Ferenc Sandor

Fruit Plant and Tree Propagation Categories

The methods to propagate asexually fruit plants are classified in two main and six sub categories:

- Rooting
  - Stock Division
  - Propagation by Suckers
  - Propagation by Runners
  - Layering
  - Propagation by Cuttings

- Plant Union
  - Propagation by Graftage
    - Bud Grafting (Budding)
    - Grafting

The following list shows the most popular propagation techniques by each category:

Table 1: Rooting Options

ROOTING	Stock Division			Gooseberry, Currant, Strawberry, Hazel-nut
	Sucker Division			Raspberry, Blackberry
	Runner Division			Strawberry
	Layering	Bank up layering		Gooseberry, Currant, Hazel-nut
		Simple layering		Hazel-nut
		Radial layering		Gooseberry, Currant, Hazel-nut
		Air layering		Litchi, Guava, Macadamia, Mango, Avocado
	Rooting Cuttings	Hardwood cuttings	Simple cuttings	Gooseberry, Currant, Quince, Fig, Olive
			Torn cuttings	Quince (dwarf)
			Hammer cuttings	Gooseberry
		Semi-wooded cuttings		Gooseberry
		Truncheons		Fig and others, which drip a white sap when cut
		Root cuttings		Guava, Apple, Blackberry, Raspberry, Breadfruit

Table 2: Graftage Options

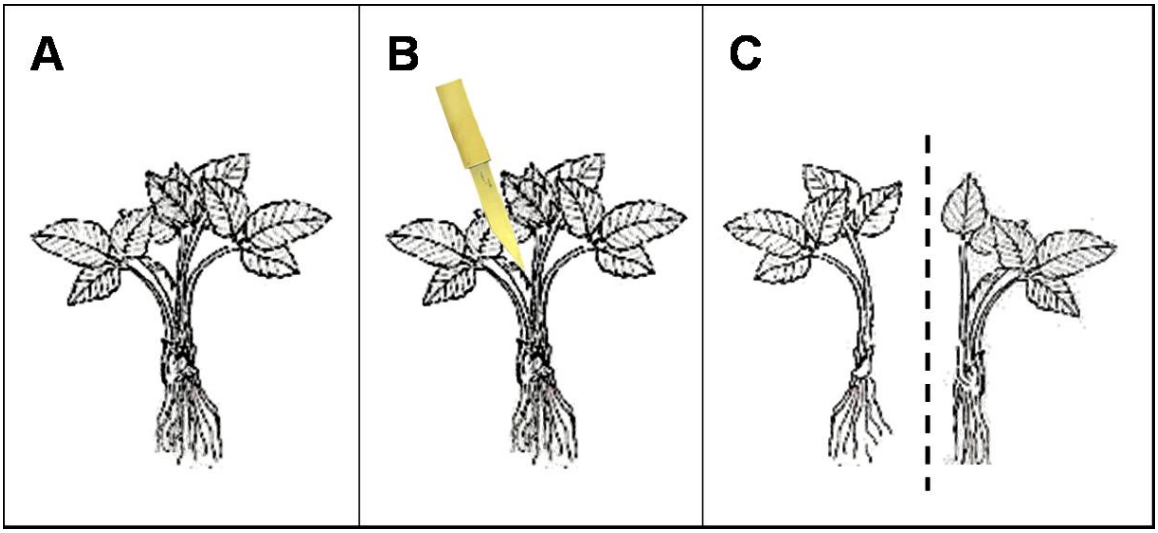
GRAFTAGE	Budding	T-budding		Pomegranate and Wooden fruit trees generally
		Inverted T-budding		Pomegranate and Wooden fruit trees generally
		Chip budding		Pomegranate and Wooden fruit trees generally
	Grafting	Whip grafting	Simple whip grafting	Pomegranate and Wooden fruit trees generally
			English (Tongue) grafting	Pomegranate and Wooden fruit trees generally
		Cleft grafting	Top cleft grafting	Pomegranate and Wooden fruit trees generally
			Side cleft grafting	Pomegranate and Wooden fruit trees generally
		Bark grafting	Top bark grafting	Pomegranate and Wooden fruit trees generally
			Wedge grafting	Pomegranate and Wooden fruit trees generally
			Slipping bark grafting	Pomegranate and Wooden fruit trees generally
			Side bark grafting	Pomegranate and Wooden fruit trees generally
			Bridge grafting	Pomegranate and Wooden fruit trees generally
			Approach grafting	Pomegranate and wooden fruit trees generally
		Green grafting	Cleft type green grafting	Gooseberry
			Whip type green grafting	Gooseberry

Vegetative Propagation by Rooting

Stock Division

This method is used when the plant produces custard of rooted stems. In the late growing season and at beginning of the dormant stage, we can divide the plant for several new specimens according to the number of rooted stems. During this process, the old part of the plant should be removed. This technique basically rejuvenates the plant.

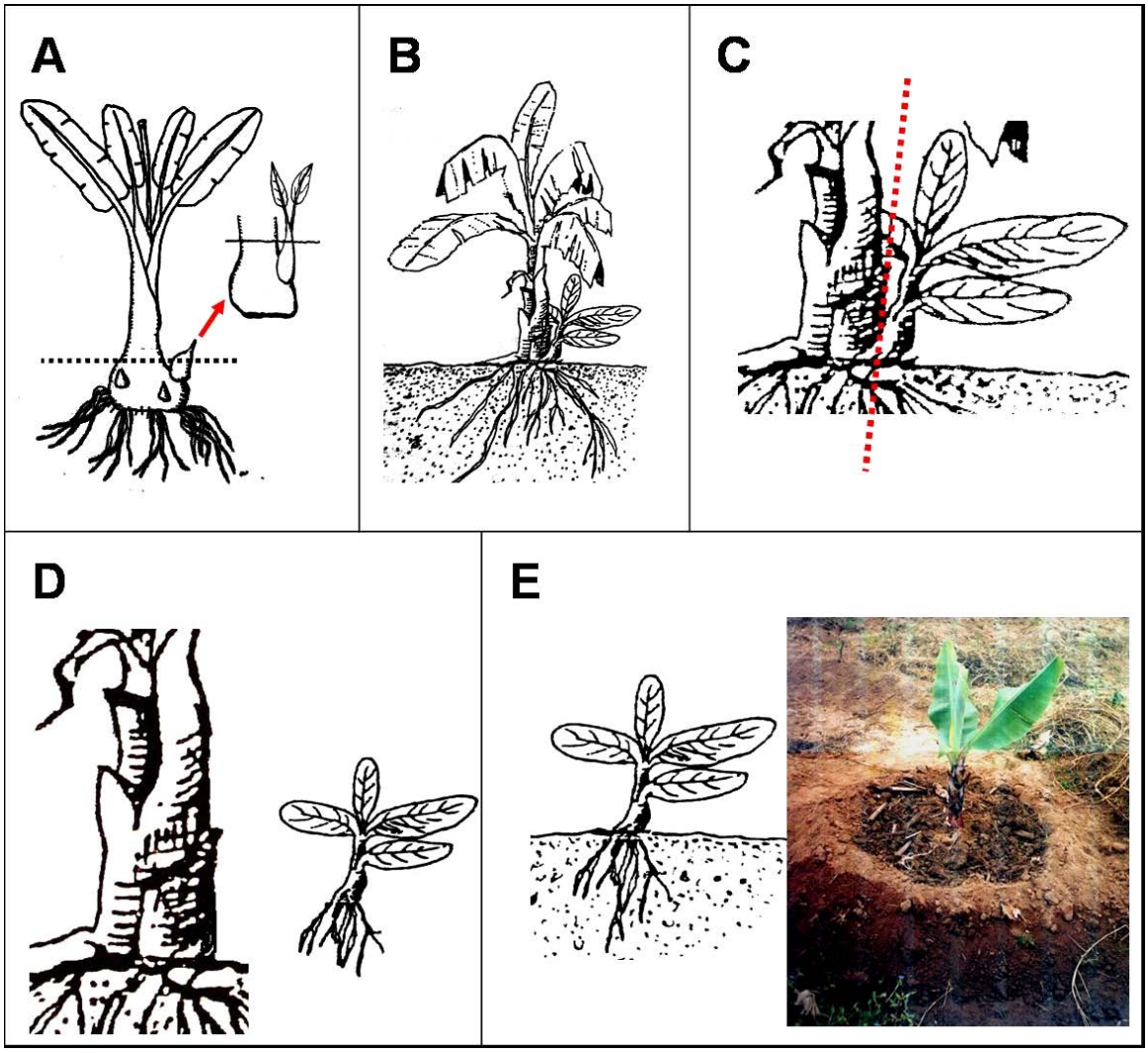
Schematic 2: Stock Division



Sucker Division

There are two types of sucker division methods, both are based on the same principle. We use the growing suckers to reproduce the plant. In one case, the sucker grows from the bud, which is located around the root neck, or from roots, which are closed to the surface. Typical examples are the raspberry and the blackberry. In the other case, the sucker grows from the bud around the true stem, called rhizome, which is a horizontal underground stem. This technique is traditionally used for banana propagation.

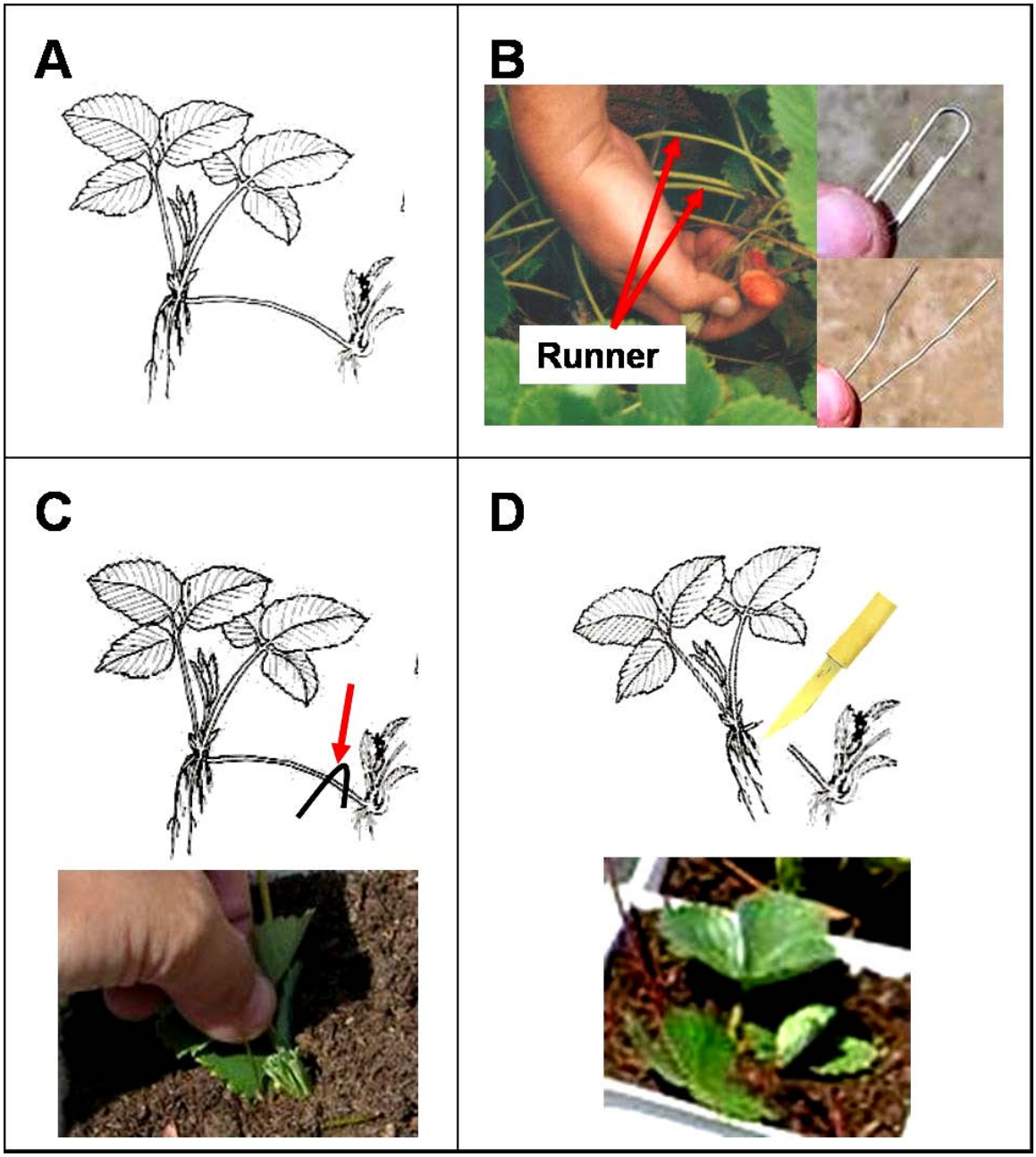
Schematic 3: Sucker Division



Runner Division

The most widely known example of propagating plants with runner division is the strawberry. After fruiting, the strawberry begins to grow several runners. Wherever the runner has contact with the surface, it will root and form a new plant. After cutting off the new plant from the mother plant, we can transplant it before the cold season begins. The new plant will then produce fruit with its highest potential yield in the next year.

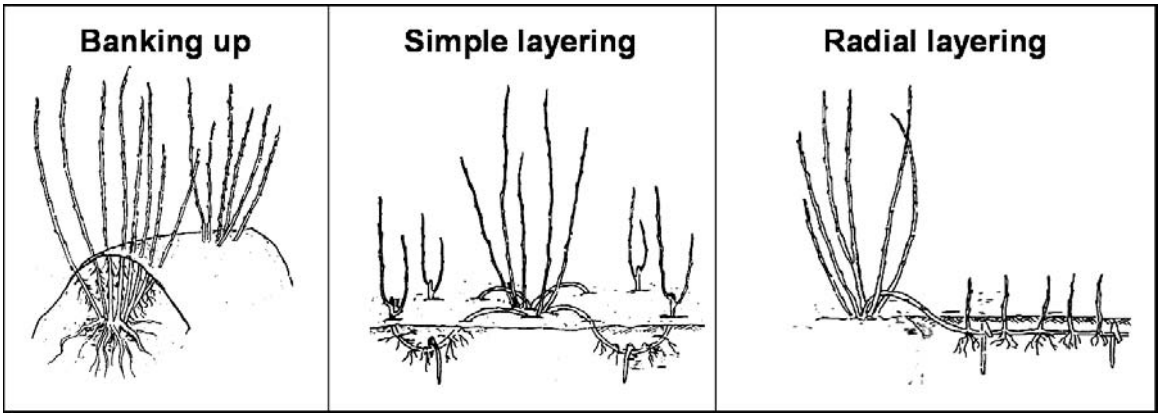
Schematic 4: Runner Division



Layering

The main purpose of layering is to provide rooting for the stem of the mother plant. The new growing plant will keep the union with the mother plant until it is able to survive on its own. When this happens, the new plant will be cut off from the mother plant. Different techniques (as shown) exist for layering.

Schematic 5: Layering



Source: Dr. Cselotei-Dr. Nyujto-Csaki: Horticulture, Mezogazdasagi Kiado, Budapest, Hungary (1985)

Banking Up

This is the most common method to propagate pear, quince and apple rootstock (M type clones). This technique needs some preparative work. For about 2-3 years, we cut back the mother plant up to the surface level (or close to it), which will then result in a thicker root neck. This thick root neck will grow custard of stems. We then have to bank up the plant to 10-15 cm high (when the stems have an average 20-25 cm length). We can subsequently harvest the rooted stems at the end of the growing season.

Simple Layering

This technique is commonly used for hazel-nut propagation. During the dormant season, stems are bent down into a 20-25 cm deep trench and covered with soil. The top parts of the stems, which usually have 2-3 buds on them, remain above the surface.

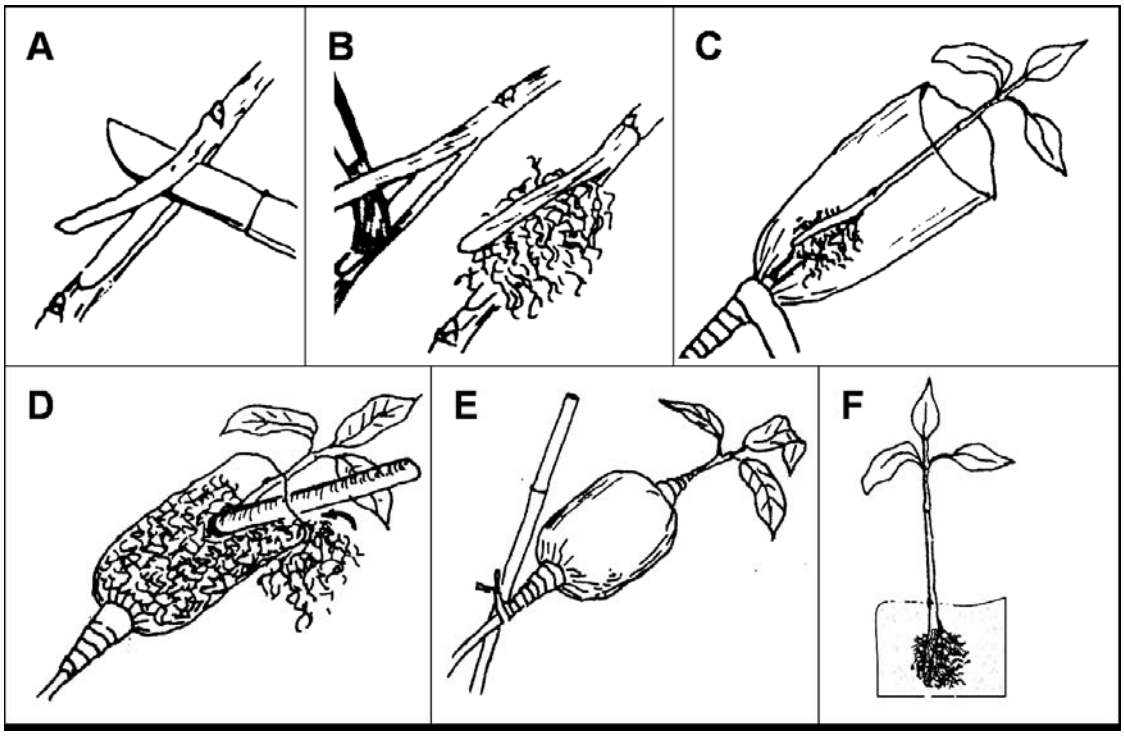
Radial or Chinese Layering

In this case, the whole stem is bent down into a 10 cm deep trench and covered with soil. We then have to bank up the suckers to 2/3 of their height on a regular bases. This occurs when the sucker grows 10cm above the surface leaving only the top 1/3 of the plant free. This method is used mostly to propagate Gooseberry, Currant and Hazel-nut.

Air Layering

This method is used on the tip of the branch, when stems are usually younger then one year old. A strip of bark is cut approximately 2 cm wide on the stem about 20 cm from the tip (just below a leaf stalk, or join). Once cut, a rooting hormone is applied and rooting material is placed under the strip. Finally, the cut is covered with a thin plastic bag, which is opened at both ends. Rooting material must be placed in the bag before it is sealed. This process must be completed during rainy conditions, when the air humidity is highest. Litchi, guava, macadamia and mango are propagated with this method.

Schematic 6: Air Layering

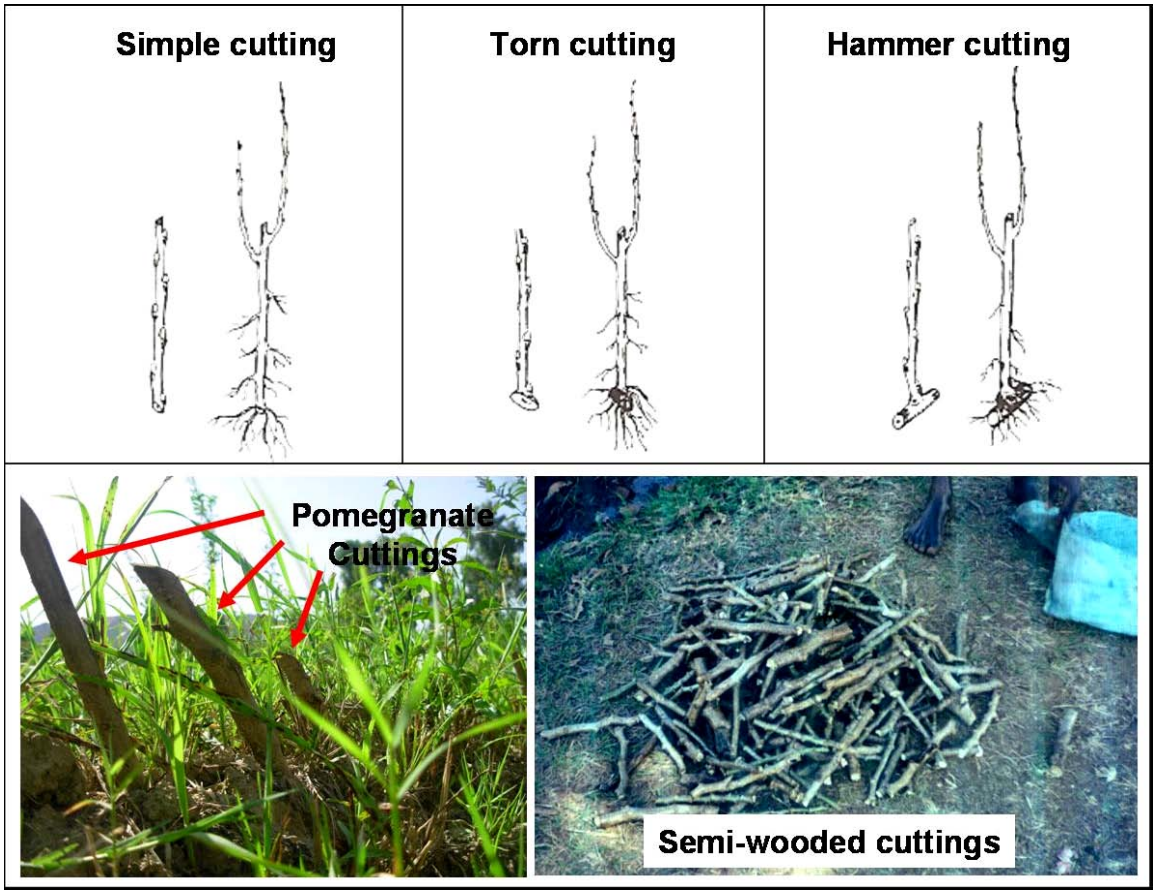


Source: Growing fruit trees. Forestry Commission, Harare, Zimbabwe

Rooted Cuttings

This method is one the most popular vegetative propagation techniques, due to its use on both fruit and vegetable plants (such as cassava). The stems, which are used for cloning, have to be harvested during the dormant stage from the mother plant. The cuttings, which originate from a piece of the mother plant, are then placed into the soil. Similar to layering, different techniques can be used for this propagation method. This method always uses cuttings from the previous season's growth (more then one year old).

Schematic 7: Hardwood Cuttings



Sources: Photographs by Ferenc Sandor. Graphic design by Dr. Cselotei-Dr. Nyujto-Csaki: Horticulture, Mezogazdasagi Kiado, Budapest, Hungary (1985)

Hardwood Cuttings

There are two types of hardwood cuttings. Those that are taken from deciduous plants (such as mulberry, grape, apple, plum, peach, pomegranate and figs and those that are taken from evergreen plants (such as olive and granadilla). Hardwood cuttings are taken from deciduous plants in early winter after the plants have dropped their leaves.

Simple Cuttings

This simple cutting is done on a stem, which usually contains 4-6 buds. The top part of the stem is cut off at an angle. If the cutting originated from an evergreen plant, the bottom two leaves should be removed and planted immediately after being cut. The shoots will then grow from the buds above the soil and the roots will grow from the nodes in the soil. Typical examples for the use of this method are the Gooseberry, Currant, Quince, Fig and Olive.

Torn Cuttings

This cutting is performed at the bottom portion of the stem where there is a union with the mother plant. This is a very old technique and it is rarely used nowadays.

Hammer Cuttings

In this case, a piece of twig is cut together with the stem. Some plant cuttings, like gooseberry cuttings, are difficult to root and the additional piece of twig helps to develop root system.

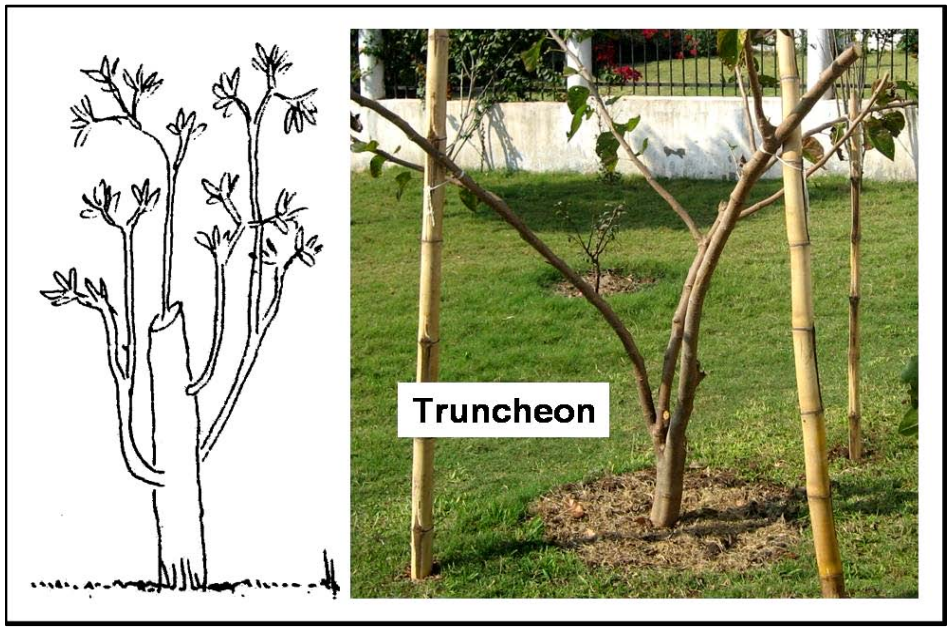
Semi-Wooded Cuttings

These types of cuttings are usually made from woody evergreen plants, which are taken during the growing season. They are cut off before the wood hardens and turns brown. Cuttings are used from the leafy shoot tip. Closed propagation structures are the best for rooting the cuttings. When the cuttings have developed their root systems, we can then transplant each one into a larger container. We use this propagation technique for the reproduction of coffee, kiwi, litchi, macadamia, mango, granadilla and pomegranate plants.

Truncheons

Truncheons are branches, about as thick as a human arm that we can grow into new plants. The branches are about 170-180 cm long. Cut the top of the branch at a slant, which prevents water from rotting the truncheon. Before planting the truncheon, it should first be kept under shade for a few days to develop a hard layer over the cut end. If the cut end is not covered with this hard layer, the truncheon may not root. The truncheon should be planted into a narrow hole about 60 cm deep. The best time for this method is the end of the dormant season when the plant still grows slowly. This method can be used with most trees which drip a white sap when they are cut.

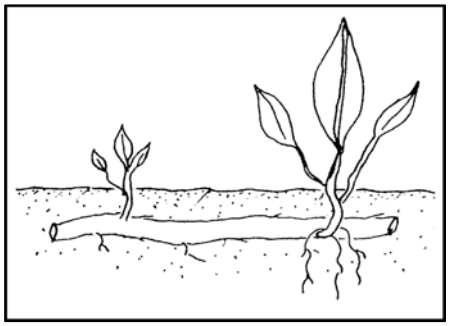
Schematic 8: Truncheons



Root Cuttings

Take root cuttings about 1 meter away from the tree trunk. These cuttings should be 20-25 cm long and 1-2 cm thick. Place these cuttings horizontally into the soil about 10 cm deep until they shoot. This technique is useful for propagation of guava, breadfruit, apple, blackberry and raspberry.

Schematic 9: Root Cuttings



Source: Forestry Commission, Harare, Zimbabwe

Vegetative Propagation by Graftage

Vegetative Propagation by Bud Grafting or Budding

The method of budding is the most common technique for plant propagation in commercial nurseries. First, one must graft a single bud attached to the stem of the rootstock. The stem or branch may not be thicker than 2 cm diameter. Therefore, this method is only applicable for young rootstock plants or smaller branches of large plants.

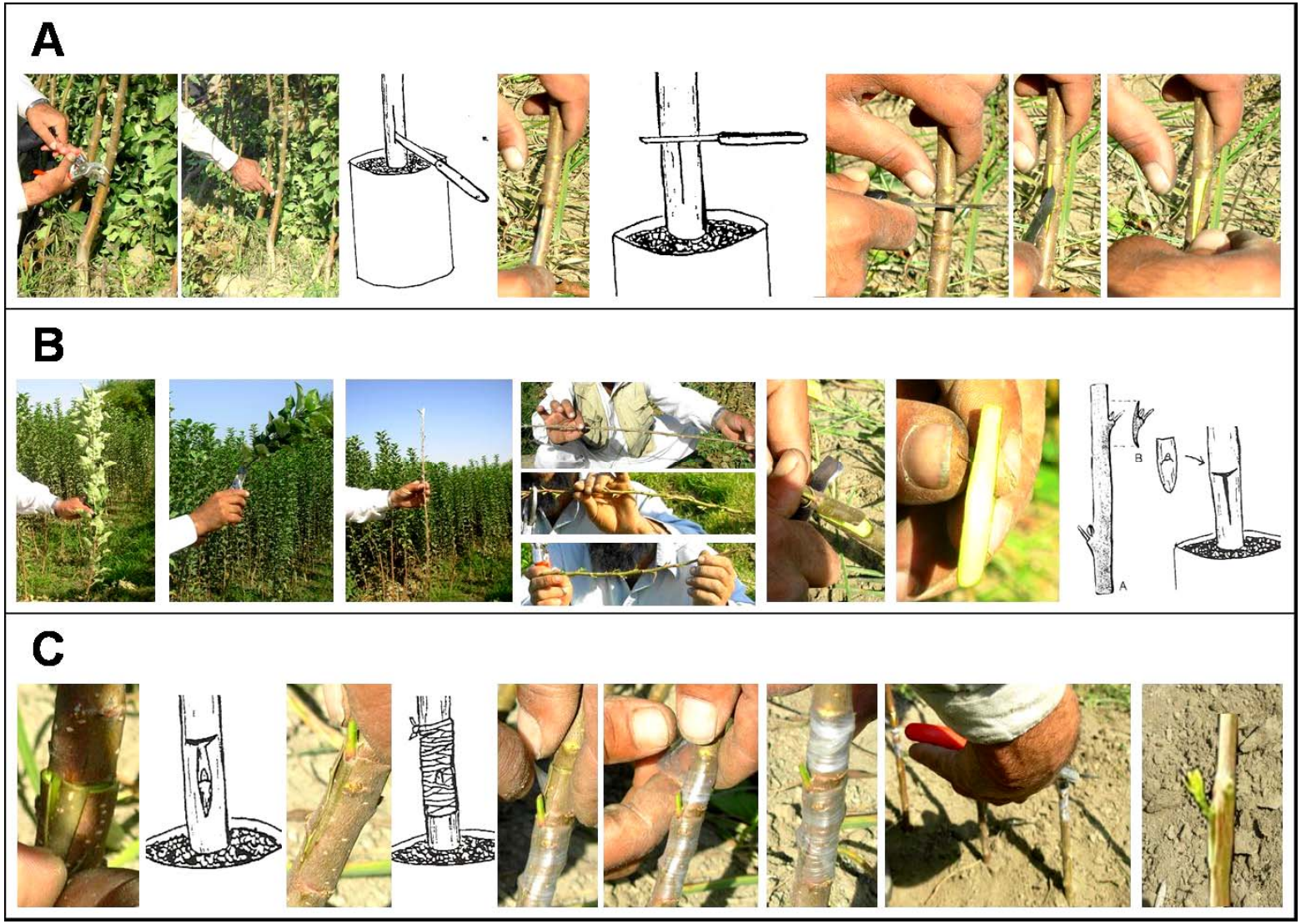
For best results, use bud wood or bud sticks which are of a vigorous current season growth. Remove the top and bottom part of the branch, because the tip buds are too immature and the bottom buds may be a cluster of buds or they are too weak to use for budding. The length of the stick is approximately 30 cm. Remove the leaves leaving a 1-1.5 cm long of leaf petiole on the stem.

The time for budding comes when the bark peels easily on the stock. Irrigation a few days before budding helps to slip the bark. One should bud graft into the root neck, or into a higher part of the plant. Normally, budding should be done about 15-20 cm above the root neck avoiding the possibility that the scion will root into the soil.

There are two periods of time to use the method of bud grafting. One option is to implement it in the beginning of the growing season. Bud grafting during this time comes with the risk that the new shoot will not be sufficiently strong and matured to survive freezing conditions during the winter. The other and most common option is budding in the beginning of the dormant stage. This means that the bud will remain dormant until the following spring. Just as growth begins, all top growth is cut off with a sloping cut 5-7 mm above the bud. All growth except the inserted bud must be removed on a weekly basis.

The bud preparation starts about 1 cm below the bud with a slicing cut under and about 2 cm beyond the bud (5-7 mm above the bud). The dept of the cut is such that only a very small amount of wood appears directly under the bud. This wood underneath the bud need not be removed.

Schematic 10: T-budding

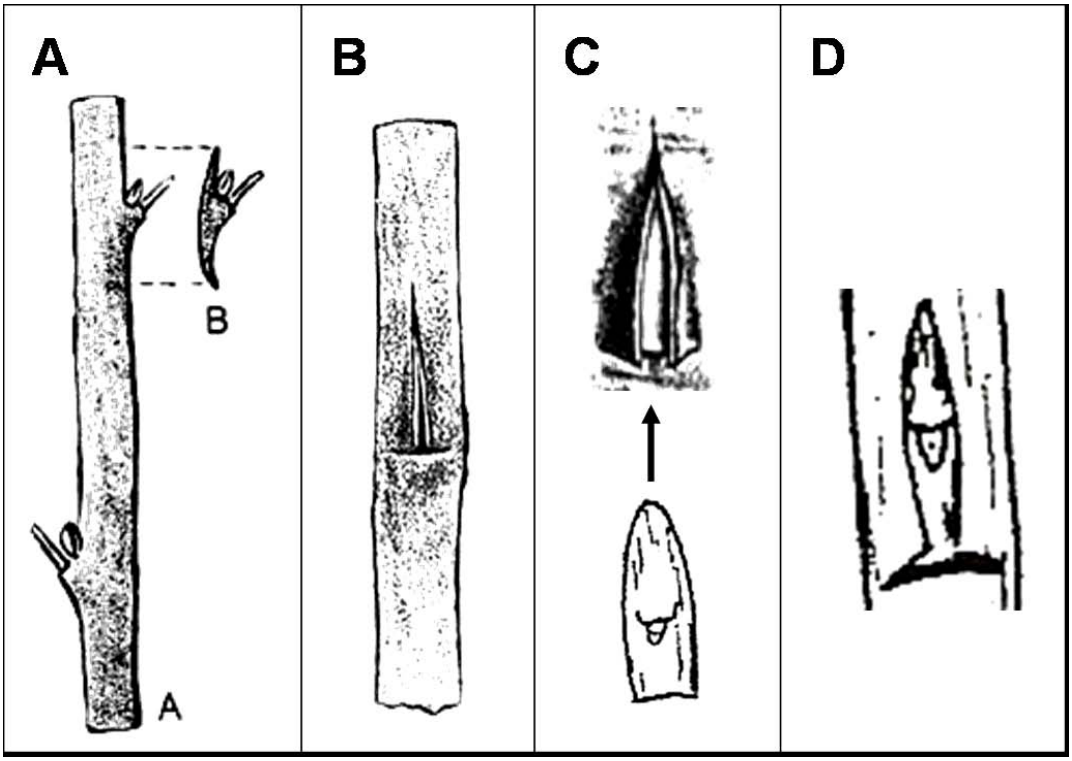


T-budding

The “T” cut on the stock is done about 20-25 cm above the surface with a 2 cm long vertical cut and a 7-8 mm long horizontal cut on the stock. A slight twist with the budding knife may open the two flaps of bark. After that, the bud should be inserted under the two flaps of bark by pushing downward. If part of the bud remains above the horizontal cut, it must be cut off. This will allow the flaps to be closed tightly. Finally, the incision should be closed with budding tape, which should be wrapped tightly around the stem. Tying must start at the bottom or the top end of the incision. After 3-4 weeks, the tape should be removed (if it did not already fall off). At this time, the shield of the bud and the petiole may indicate the condition of the bud. If the shield is shriveled and the petiole does not fall off at the touch, the bud is possibly dead and the budding process should be repeated.

Inverted T-budding

Schematic 11: Inverted T-budding



Source: Photo by Ferenc Sandor. Graphic design by L.P. Stoltz-J. Strang, Reproducing Fruit Trees by Graftage, Budding and Grafting, University of Kentucky-College of Agriculture (2004)

The inverted T-budding technique is exactly same as the normal T-budding method with the exception that the horizontal cut is made on the bottom end of the incision. In this case, the bud is cut from the bud stick by starting above the bud and exiting below it.

Currently most fruit trees are propagated with the T-budding method. However, the use of inverted T-budding technique, it is much more effective due to the downward flow of

hormones that are intercepted below the bud. Therefore, the union will be stronger and the healing process will be faster (as opposed to the normal T-budding method).

Chip-budding

Chip-budding does not use the protective bark flaps as T-budding does, but it also does not use slipping bark. The first step is to make a cut about 2-2.5 cm long with a depth of ¼ to 1/5 the diameter of the stock. With a horizontal cut made on the bottom, the cutting can be removed. The bud can also be cut off if necessary. The bud stick and stock must be the same diameter. The stock and scion must be placed together in such a way that allows the cambia of the bud and stock to match together as much as possible. Desiccation is a high risk when we use this method, therefore, the wound should be wrapped tightly with grafting tape.

Schematic 12: Chip-budding

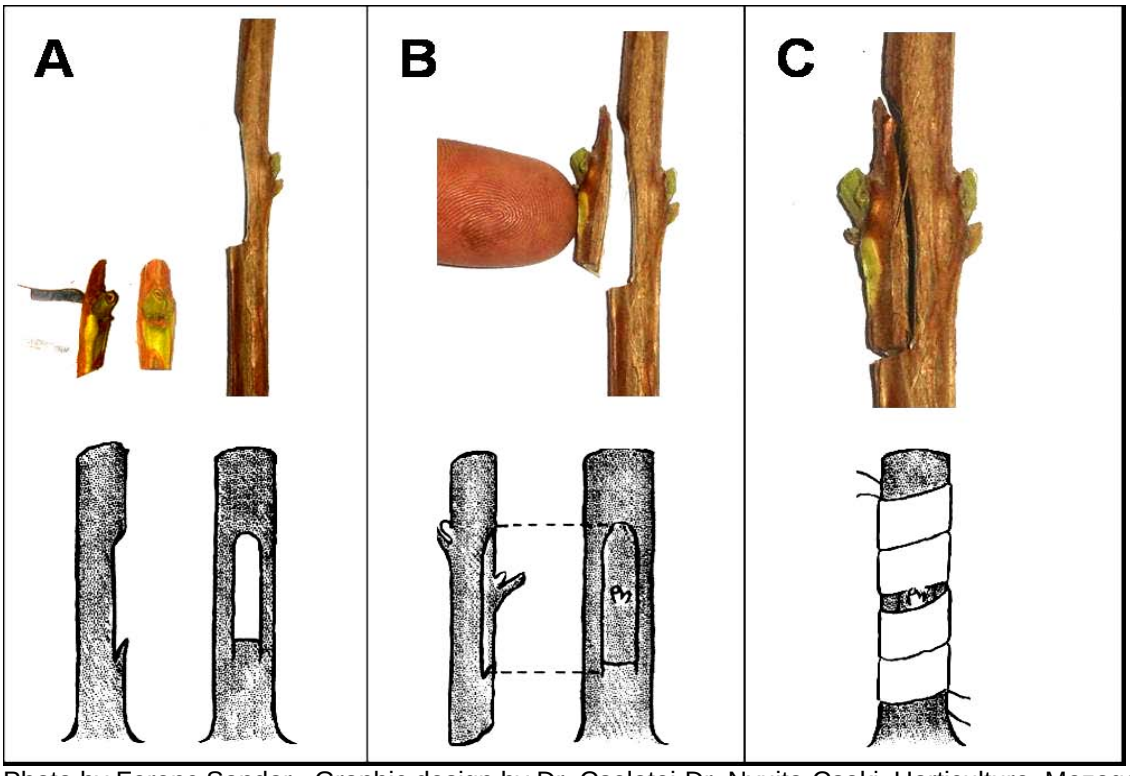


Photo by Ferenc Sandor. Graphic design by Dr. Cselotei-Dr. Nyujto-Csaki, Horticulture, Mezogazdasagi Kiado, Budapest, Hungary (1985)

Vegetative Propagation by Grafting

Two types of rootstock can be used for grafting: the cultivar and the seedling rootstock. The cultivar rootstock is produced by vegetative methods, generally by layering and cuttings. Seedling rootstocks grow from seed. One of the best examples for cultivar rootstock is the apple and for the seedling rootstock, the mango.

During the selection of the scion wood we have to consider some important aspects:

- The scion wood must carry healthy buds that will grow into leafy shoot
- It should come from a tree which is free from any pests or diseases
- The plant should have the required characteristics. This includes, that we take scions from plants, which is already bearing fruits.
- Buds, which already begin to grow, are useless for grafting. The grafting process will fail.
- The one year old wood is the best for grafting. These shoots grew during the previous year. Water sprouts from up in the tree make straight scions.

There are some rules, which must be taken consideration for any grafting method to be successful:

- Two incompatible plants cannot be grafted
- The cambium layers of the rootstock and the scion must touch
- The scion must be the right way up when you graft it
- You can grafting in any time of the year, but the best time for deciduous plants is, when the plant drops its leaves and is dormant
- Cool, cloudy day without wind prevents the graft from drying out, therefore this type of weather is the best for grafting
- The care activities are very important until the rootstock and scion are properly joined

These grafting process use a sharp knife, tape and grafting wax. Grafting wax seals the join wound and avoids water loss and disease infection. Therefore, its use is strongly recommended. If grafting wax is not available, we can use petroleum jelly (Vaseline) or we can produce home made grafting wax. There are two ways to make grafting wax:

5 Kg resin
1 Kg bee wax
½ Kg siliceous earth (Fuller's earth)

or

2½ Kg paraffin wax
1½ Kg siliceous earth
½ Kg Zinc oxide

In some cases, a section of trunk is introduced between the rootstock and scion. It is called inter-stem or inter-stock. This is done in order to have a desired effect or characteristic on the tree. These effects can be disease resistance, winter resistance or effects on the size of the tree. It is also used to join two incompatible cultivars together.

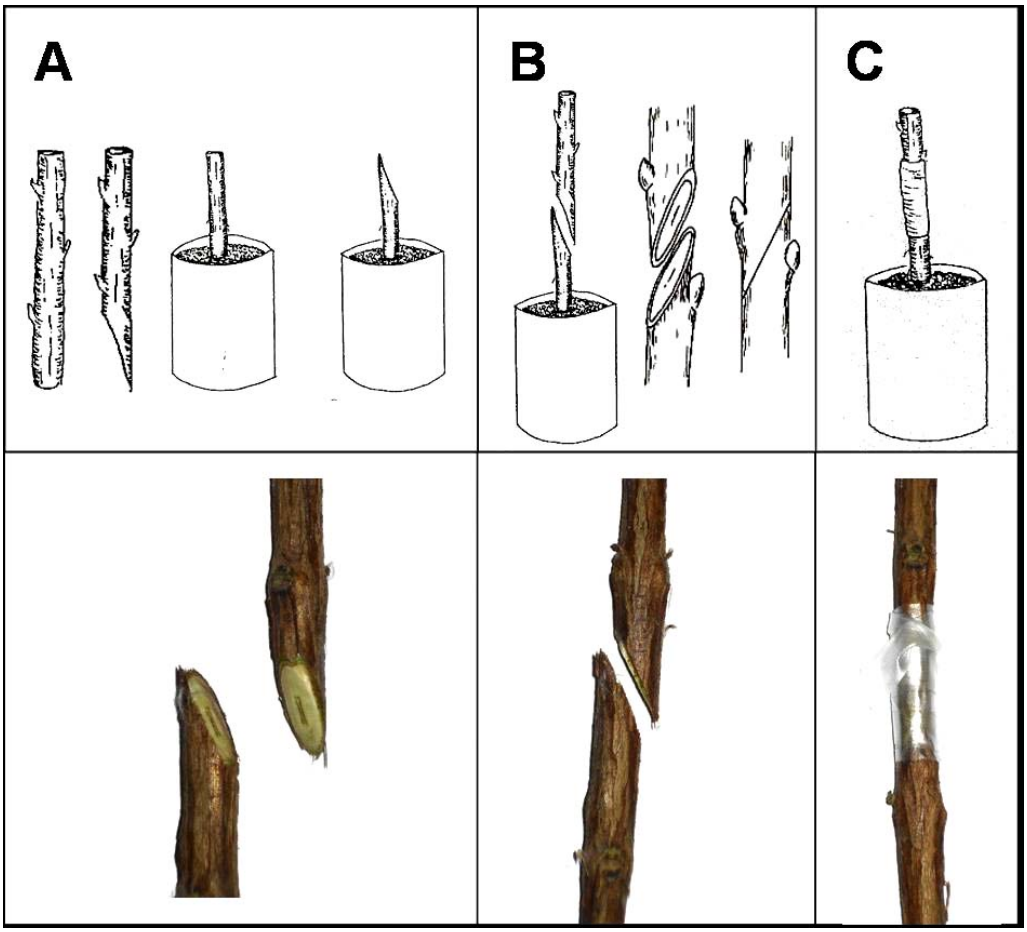
Whip Grafting

The whip graft is useful for plants that unite easily. This method is useful for apples, mangos and pears. It can be used to graft root, stem or top graft. The diameter of the scion and rootstock should be the same, from the size of a pencil to 10-15 mm.

Simple Whip Grafting

This type of grafting practice includes the process of a simple sloping cut on both the scion and the rootstock. The two parts should over lap each other perfectly. In any case, one rule must be followed: The wider the scion and root stock, the longer the cut surface.

Schematic 13: Simple Whip Grafting

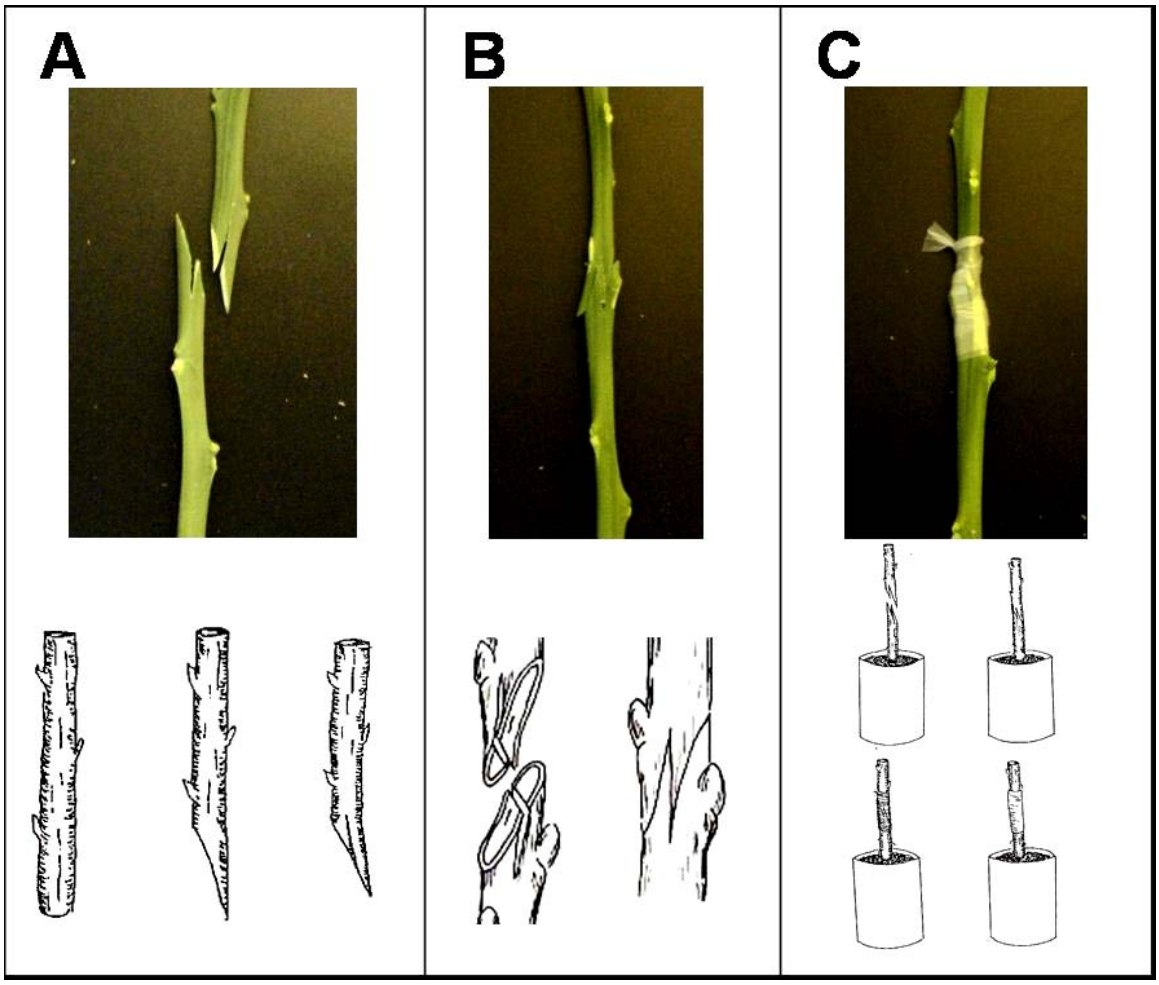


English (Tongue) Whip Grafting

This method is more common in practice, especially in the case of pear and apple trees. It is used to graft thin stems. It may be used on roots, stems or tops. The scion should have two or three buds with the graft made below the bottom bud. The first cut is a 2-5 cm sloping cut at the bottom of the scion. The second cut is made with a distance 1/3cm from the tip of the first cut. The same process is repeated on the rootstock. In apple

propagation, the tongue grafting is mainly used to graft on M4 (semi-dwarfing – 5m height) and M9 (very dwarfing – 3m height) rootstock.

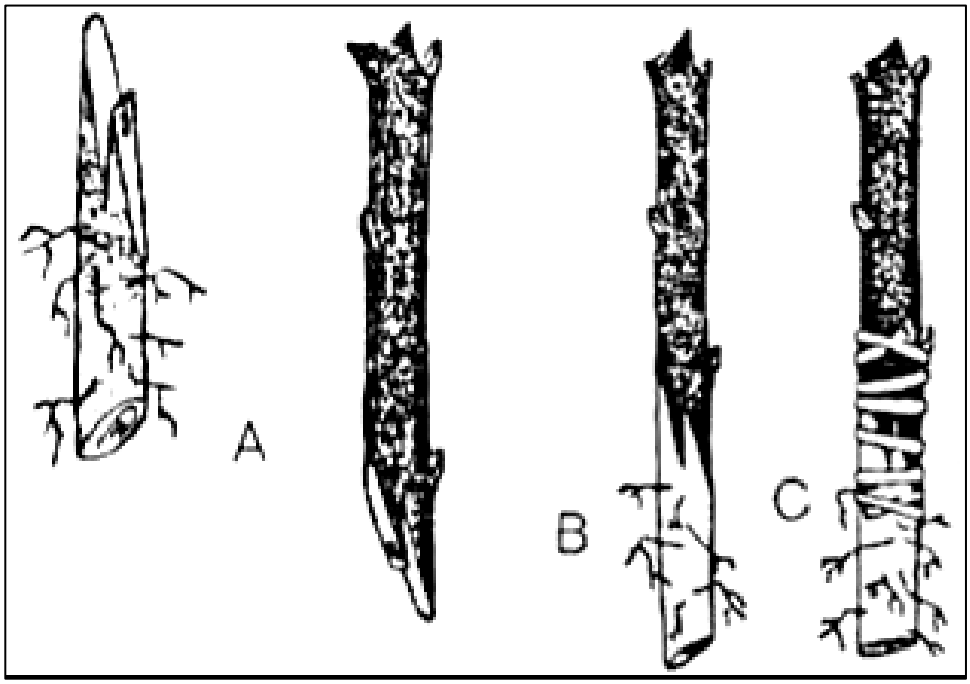
Schematic 14: Tongue Whip Grafting



Root Tongue Grafting

Root grafting is used for propagation on a rootstock seedling, however the rootstock cannot belong to the dwarf category. This is due to the fact that it causes the rooting of the scion. We use a piece of 8-10 cm long root and a little bit longer scion. Root grafting is done when the apple rootstock and scion are dormant. This method is normally not used for pears.

Schematic 15: Root Tongue Grafting



Source: Photo by Ferenc Sandor. Graphic design by L.P. Stoltz-J. Strang, Reproducing Fruit Trees by Graftage, Budding and Grafting, University of Kentucky-College of Agriculture (2004)

Cleft Grafting

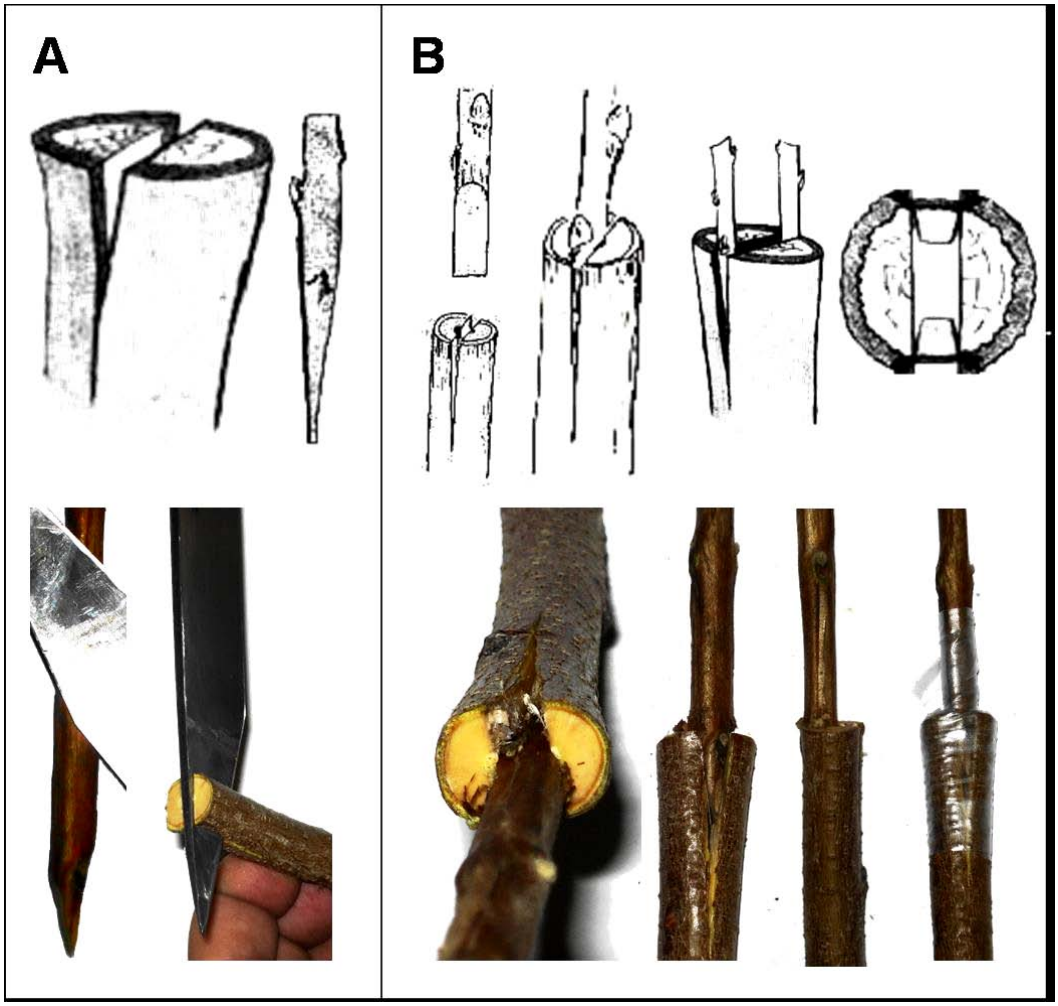
This method has been practiced throughout the history of horticulture and is one of the oldest fruit propagation techniques. It is suited for apple and pears, but, in tropical areas, in can also be used for propagation of mango and avocado trees. Citrus and guava trees also use this method. In the case of top and side work, the scaffold limb is usually wider than the scion. In the case of tree propagation, both parts, the rootstock and scion, should be the same size.

Top Cleft Grafting

For this method, the scaffold limb of the stock should be 4-6 cm wide. It should be straight and growing vertically. It should be free from spurs, knots and cankers. The limb must be cut where the amputation point is keeping the limb from splitting or the bark from peeling. After that, the stock must be split across the center to a depth of about 15 cm. Next, cut the scion 20 cm long and make two sloping cuts about 4-5 cm long. The wedge of the knife should be driven into the center of the split that was held apart and

subsequently joined with the scion and the stock in a way that the two cambia will be in contact with each other. Usually, we use two dormant scions for the two opposite sides of the split.

Schematic 16: Top Cleft Grafting

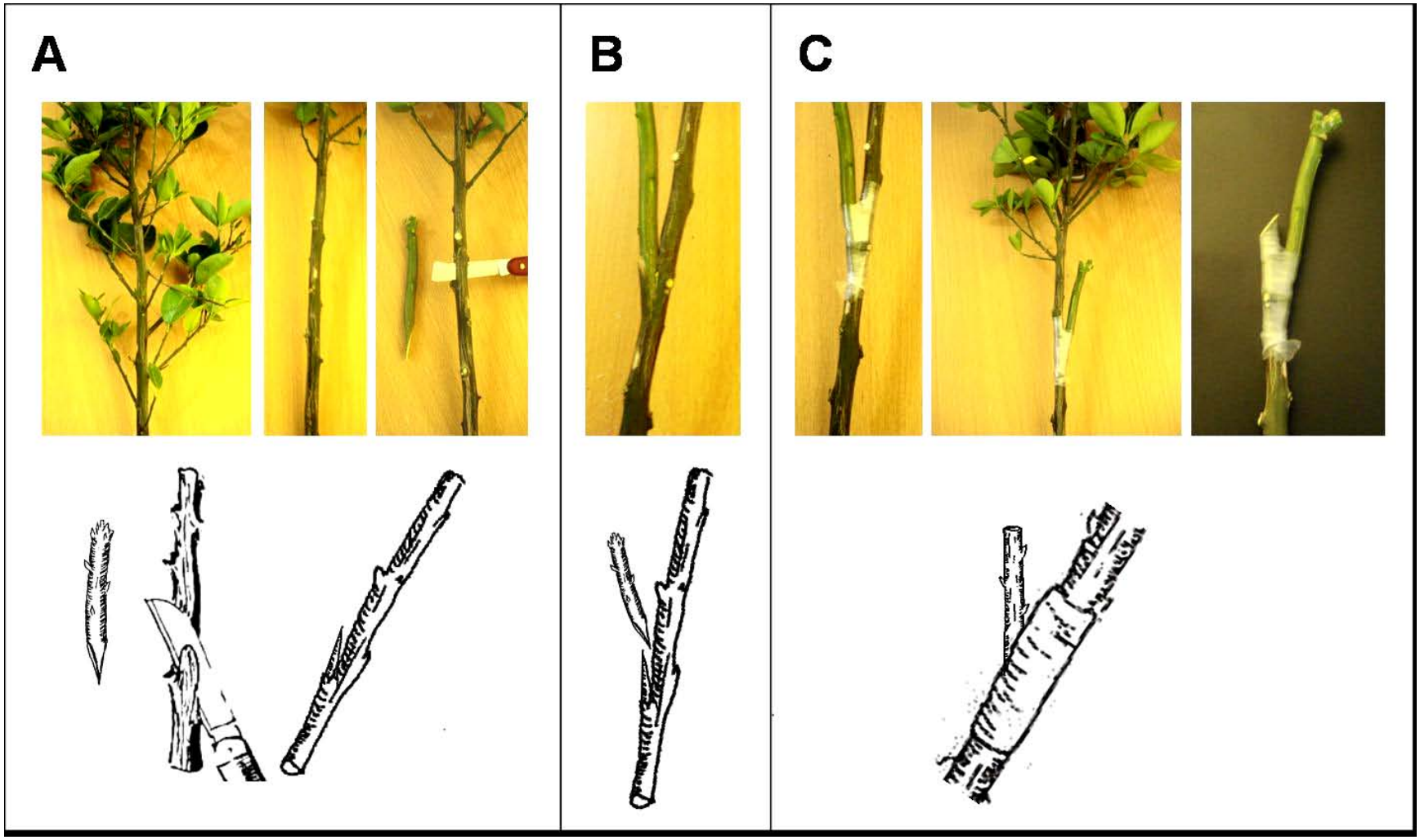


Source: Photo by Ferenc Sandor. Graphic design by L.P. Stoltz-J. Strang, Reproducing Fruit Trees by Graftage, Budding and Grafting, University of Kentucky-College of Agriculture (2004)

Side Cleft Grafting

The processes are similar to that of the top grafting method, however, grafting is done on the upward side of the limb. Additionally, the limbs are not amputated until the grafting scion begins to shoot. The stocks are then split with a diagonal cut about 3-4 cm long and 1/2 cm deep and are joined with the scion at the stock. The next step is to tie and wax the graft. The scion must be covered with a small, thin plastic bag that contains a piece of paper to prevent the scion from drying up. This bag can be removed after 7-10 days. When the scion begins shooting, cut the limb closest to the grafting point.

Schematic 17: Side Cleft Grafting



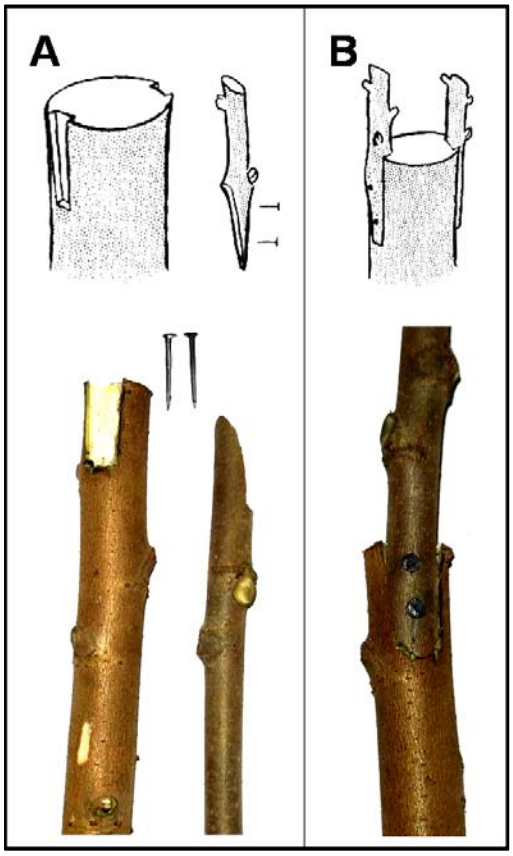
Bark Grafting

Bark grafting is used when the stock is too large for whip grafting. It is one of the most difficult grafting techniques. Perfect application of this method requires much practice and experience. The use of this technique is common for pear, apple and different nuts grafting.

Top Bark Grafting

In this method the dormant scion should be used. The stock should be grafted when the bark begins to slip. The first step is to cut squarely across trunk (4-6 cm diameter). After the scion is cut across, a slopping cut of about 4-6 cm is made, which is done above the top bud (7-8 mm). The scion must be joined at the surface against the side of the stock. Finally, fix the scion with 2 nails and wax it once this is complete. Keep the trunk below the joining point so that it can be free from sprouts and shoots.

Schematic 18: Top Bark Grafting

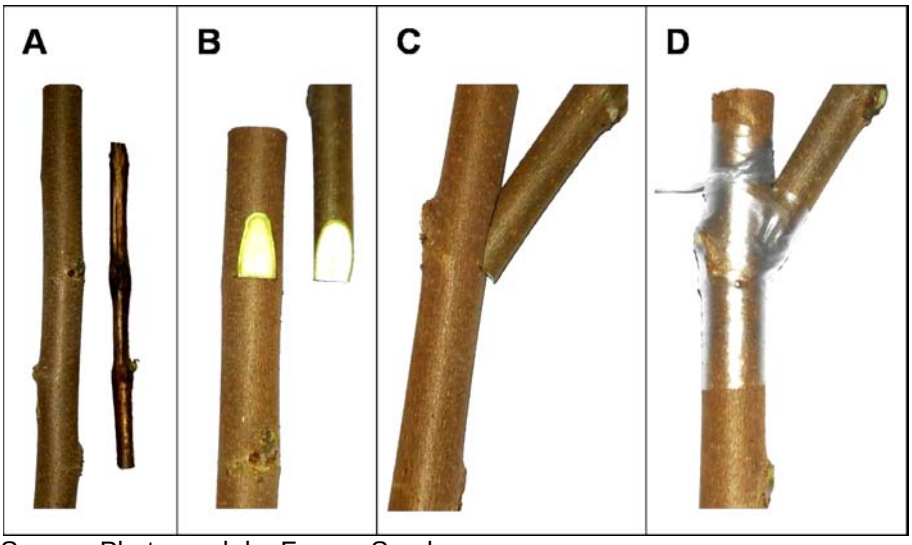


Source.: Photo by Ferenc Sandor. Graphic design by L.P. Stoltz-J. Strang, Reproducing Fruit Trees by Graftage, Budding and Grafting, University of Kentucky-College of Agriculture (2004)

Side Bark Grafting

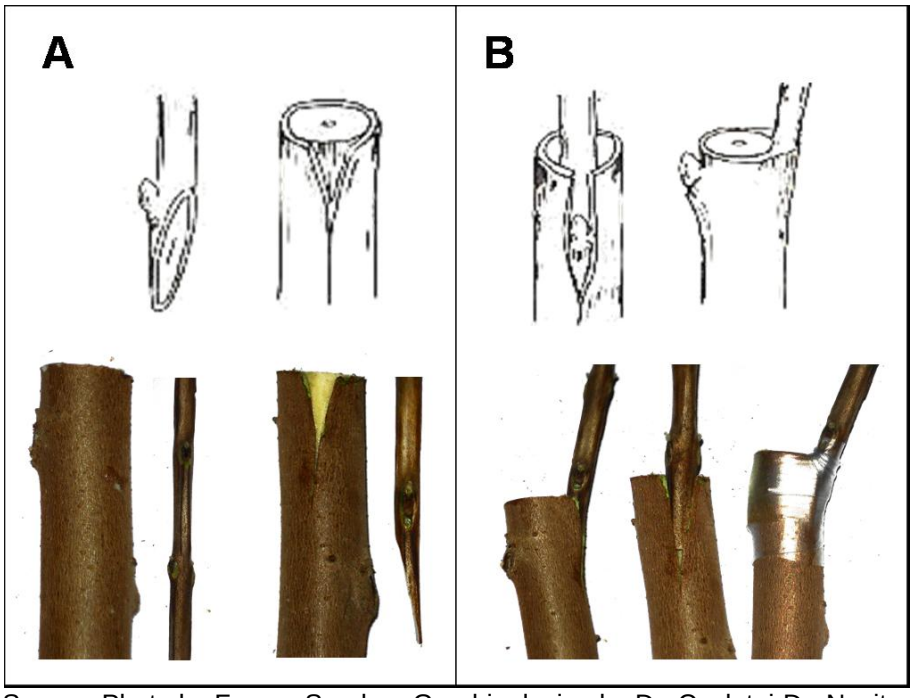
This technique is very similar to the top bark grafting. The square cut is 2-3 cm long and 8-10 cm wide. The joining part is then tied. Nails are not used and the branch of the stock above the joining point should be cut off after the scion begins shooting. This method is most commonly used during the growing season.

Schematic 19: Side Bark Grafting



Source: Photograph by Ferenc Sandor

Schematic 20: Slipping Bark Grafting



Source: Photo by Ferenc Sandor. Graphic design by Dr. Cselotei-Dr. Nyujto-Csaki, Horticulture, Mezogazdasagi Kiado, Budapest, Hungary (1985)

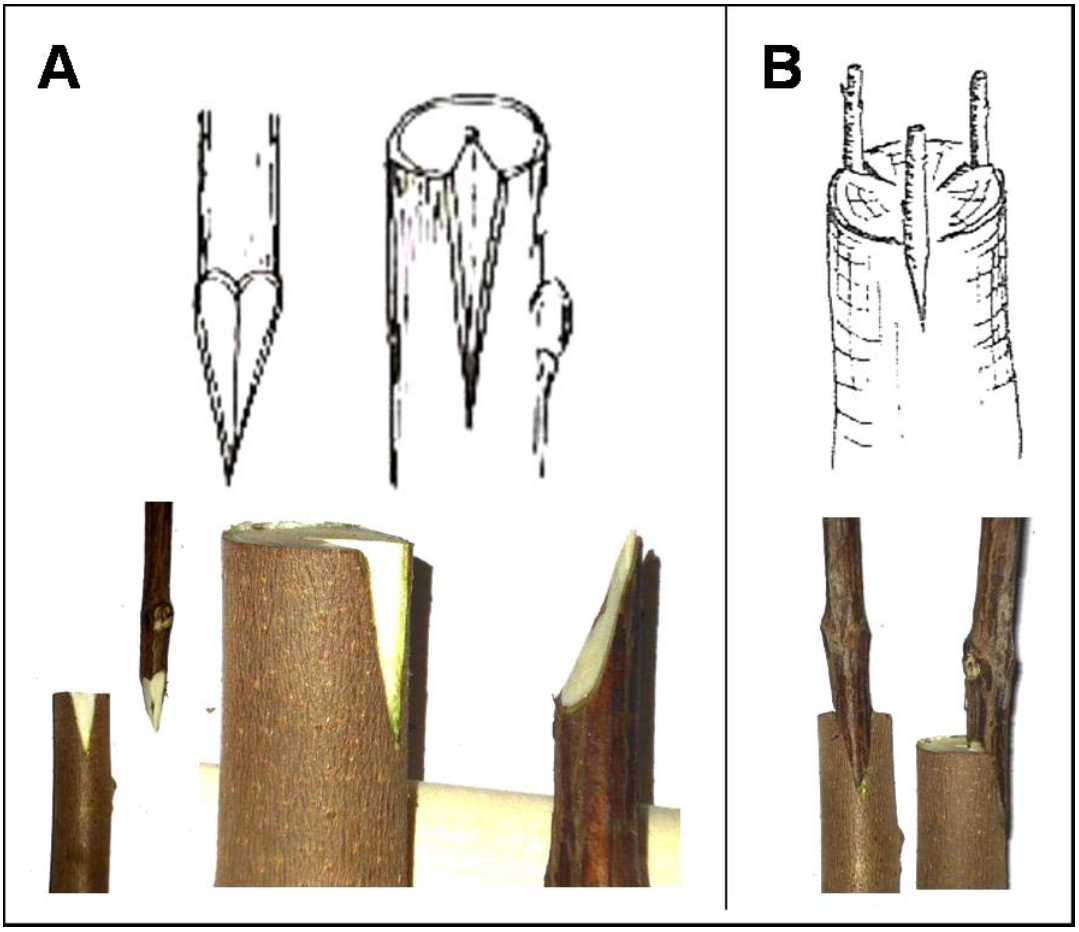
Slipping Bark Grafting

The technique has many similarities with the budding methods and can be applied during the same period, when the bark peels easily off the stock. The first step is to cut back the stock. Next, make a 15-20 cm long cut on the bark from the point where the stock was cut back. The cut is similar to the cut used for T-budding; however, only cut the bark for slipping bark grafting. The scion preparation is easy. First, make a sloping cut on the stick. A slight twist with the grafting knife may open the two flaps of bark. After that, the scion should be inserted under the two flaps of bark by pushing it downward. Finally the incision should be closed with budding tape, which should be wrapped tightly around the stem.

Wedge Grafting

This method is one of the most difficult propagation techniques. To perform a good quality wedge grafting requires a high level of skill and a great degree of experience. This method is to be used for working on the tops of trees. For small trees, graft into the trunk; while for large trees, graft into the main branches. The stock may be much wider than the scion. The method may be used during dormant stage. The scion, like in other cases, should contain a minimum of 3 buds and its length should be approximately 20-25 cm. Now, cut the base of the scion to a long wedge that is sloping both downward and inward. Use a thin-bladed saw to make a cut (or various cuts according to the size of the stock) to approximately the center of the stub. Wide the cuts with a round-bladed grafting knife to fit the cuts on the scion. Place the scion into the cut. If the scion matches the cut in the stub, they are held by being tapped in place. Be sure, that the cambium of both, the scion and stock, is in contact to each other. Finally, cover the graft union and the end of the scion with grafting wax.

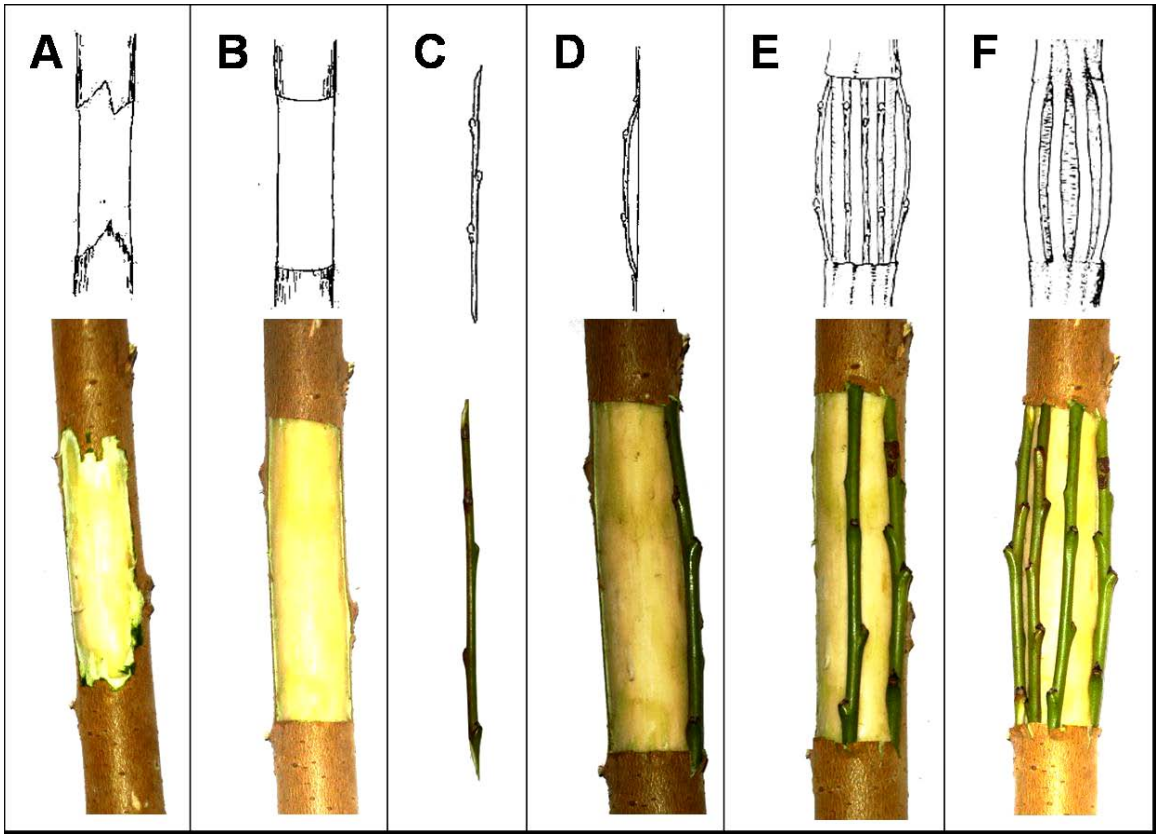
Schematic 21: Wedge Grafting



Bridge Grafting

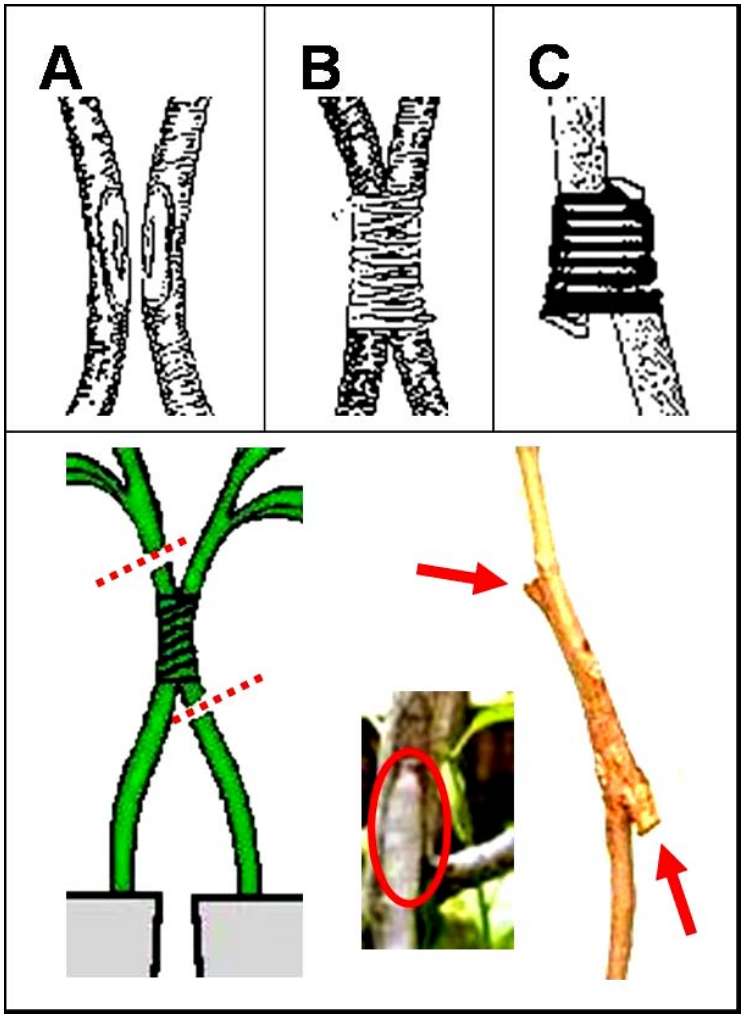
This technique is mainly used to repair damaged trees or branches and not for propagation. Like in the case of the slipping grafting, bridge grafting requires grafting under the bark. Where bark of the branch or trunk is damaged, first clean up the surface and cut a wedge in the bark horizontally. Next, prepare 3-6 scions according the size of the damaged area and graft both ends of each of the scions under the bark.

Schematic 22: Bridge Grafting



Approach Grafting

Schematic 23: Approach Grafting

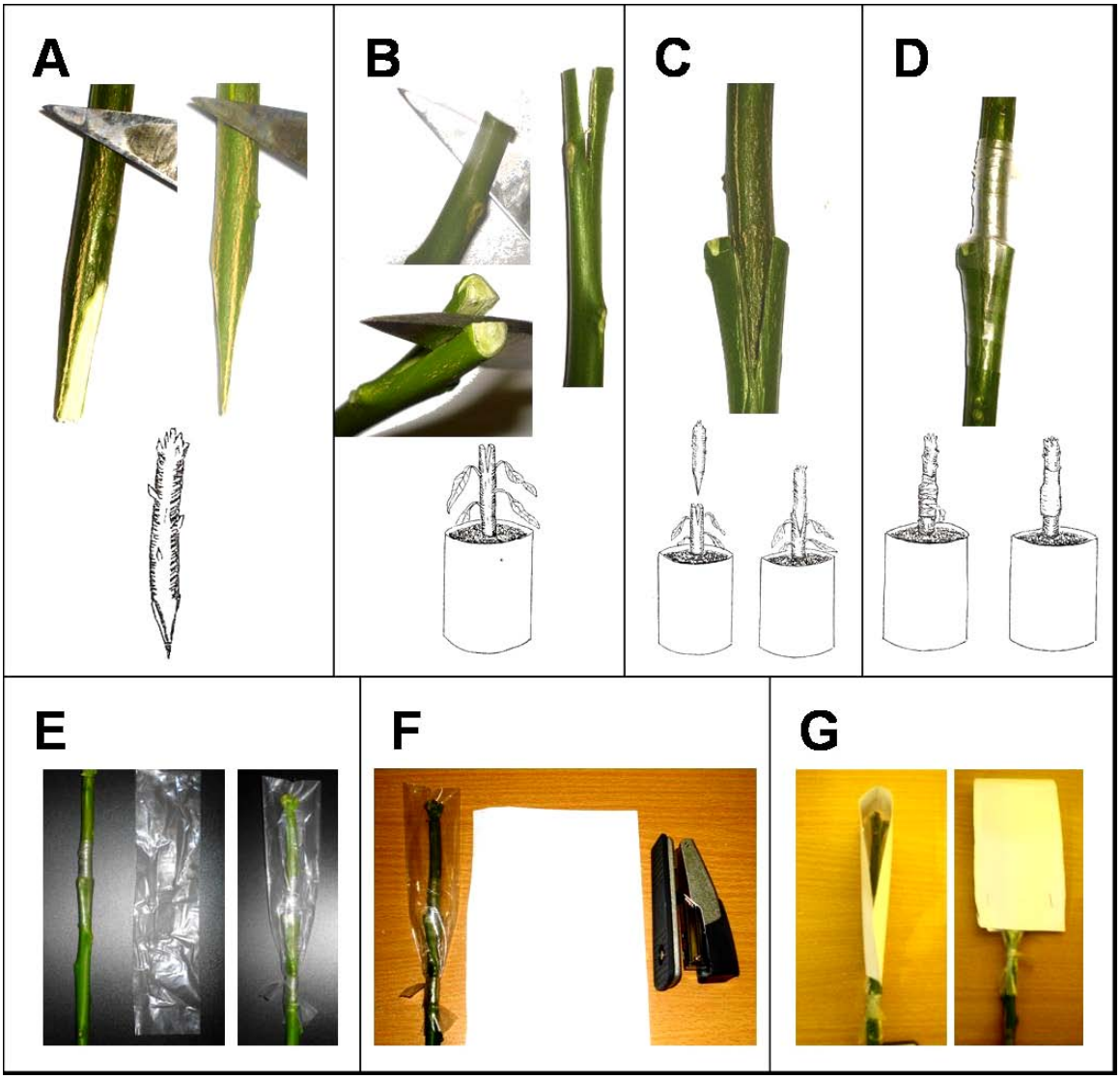


Some trees are very difficult to graft such as mango and macadamia. In these cases we can use the approach grafting method. The main difference between these techniques and other methods are that the scion is attached to its root system during the grafting process. Take two plants. One will be the rootstock and the other the scion. Make the same cut on both stems at the same height. Hold the two stems together and tie them with tape. When the grafts have joined, remove the top of the rootstock plant with a cut above the joining point and remove the bottom of the scion plant with a cut below the joining point.

Green Grafting

In some cases such as grafting gooseberry, it is very difficult to graft wooded plant parts. Therefore the two options to use are top grafting, when the stock was cut back or side grafting. Both cases use cleft or whip grafting methods. Top cleft grafting to produce a fruit tree requires a cut in the scion 20 cm long and also requires the removal of all leaves. Be sure that the top bud is well developed and healthy. Make two sloping cuts 2-5 cm long. Cut the top of the rootstock 20-40 cm above the surface. Make one straight cut across the center, the same length as the cut on the scion. Firmly join the two parts. Finally, tie and wax the graft.

Schematic 24: Green Cleft Grafting



Source: Photo by Ferenc Sandor. Graphic design by Forestry Commission, Harare, Zimbabwe

Taking Care of Grafted and Budded Plants

During the grafting process, be sure to clean and sharpen budding and grafting knives that have been used. The ready graft should be fixed with tape and the wounded surface should be covered with grafting wax in order to keep the scion or bud from losing water and drying up.

Five days after grafting we need to check the graft and re-wax it if the wax has cracked. Any shoots which grow below the graft on the rootstock should be removed, because they compete with the shoots of the scion.

Recently grafted trees need a lot of water distributed on a regular basis.

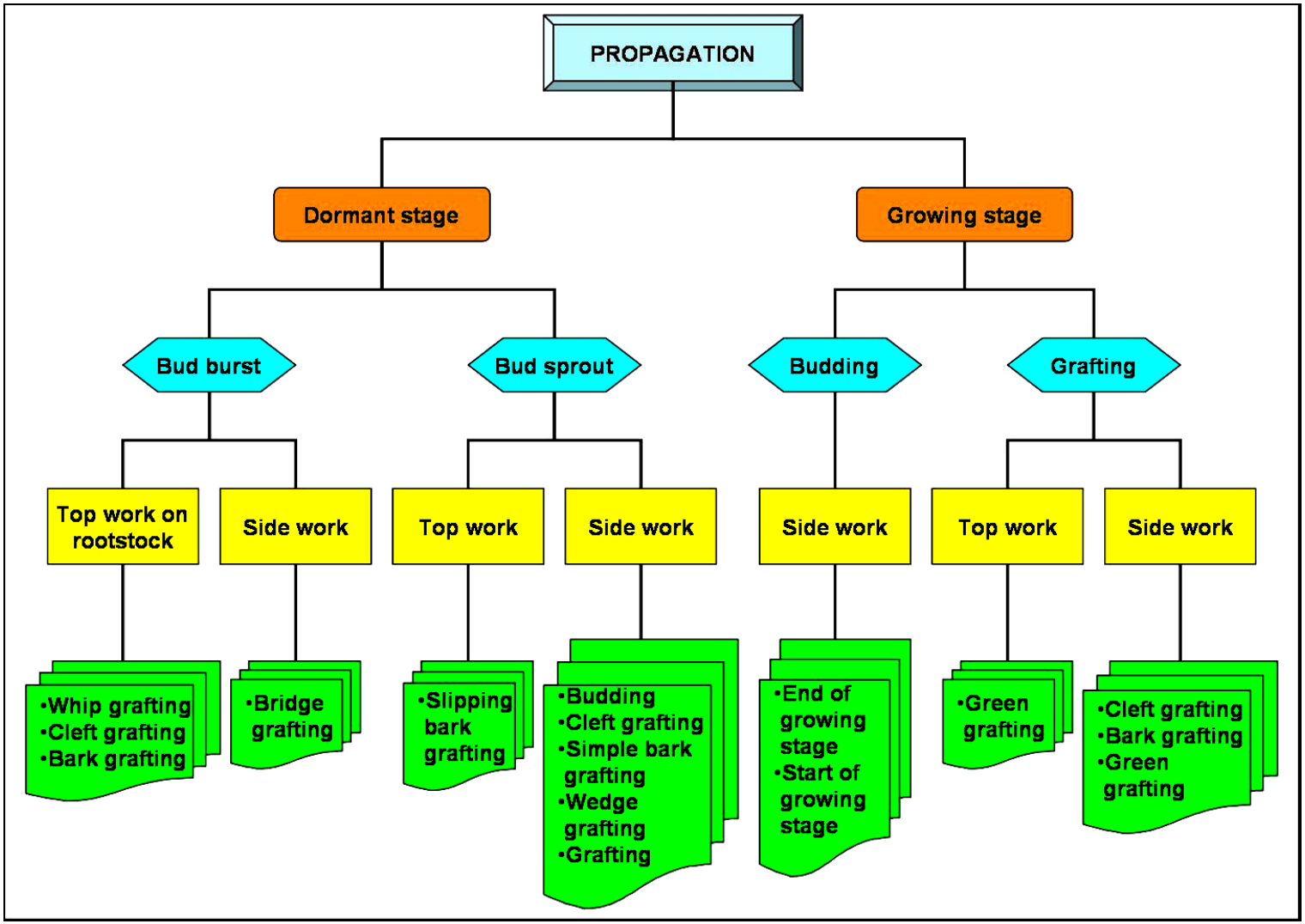
In the first year after grafting, avoid the application of any fertilizer, manure or compost, because the tree will begin to grow fast prematurely, which will not allow the graft to heal properly.

Budded plants should be kept under cool conditions until the graft has joined in order to keep the bud from growing prematurely.

As soon as the growing season starts, cut off the rootstock above the plant with a sloping cut. This will help the bud to begin growing.

Rub off the buds on the rootstock below the grafted bud as these other buds will only provide unnecessary competition with the grafted bud. This activity should be done on a regular basis until the rootstock buds stop appearing.

Schematic 25: Application of Propagation Techniques



Glossary of Terms

Bare root	Nursery stock in which the plant is sold without soil around the roots.
Budding	It consists of inserting a single leaf bud (scion), with or without attached bark and wood piece, into the stock by specific techniques.
Bud stick	It is the current season's shoot growth, which contains the buds for budding purposes.
Callus	A mass of parenchyma cells, which are able to regenerate tissue. It grows from and around the wounded tissue.
Cambium	A single layer of cells between bark and wood tissues. It produce the cells of phloem on the outside part and on the inner side develops the xylem (wood tissue).
Canopy	The part of the tree composed of leaves and small twigs.
Clone	A specific cultivar propagated asexually (vegetative propagation).
Crown	The aboveground parts of the tree, including the trunk. The root crown is the trunk below ground and the large roots coming from the trunk.
Cultivar	It is the variety, which was originated from a controlled cross under cultivated conditions.
Dormant stage	When the tree is not actively growing.
Graftage	Vegetative propagation, which uses budding and grafting techniques.
Grafting	They are various techniques to insert a piece of stem with buds (scion) into the stock.
Heading	Removing a portion of a shoot or branch, leaving only buds or a tiny twig on the remaining portion; results in an increased number of branches.
Inter-node	The part of a stem between two nodes.
Inter-stem or Inter-stock	It is a section of trunk, which is introduced between the rootstock and the scion cultivar.
Latent bud	A dormant bud that is more than 2 years old but has grown enough each year so that its growing point remains at or near the surface of the bark.
Lateral	A secondary branch arising from scaffold limbs.

Leader	A dominant upright branch. The central leader is the trunk that extends from the root to the top of a tree.
Primary scaffold limb	One of the major limbs arising from a tree trunk.
Rootstock	It is the part of the grafted or budded tree, which will be the root system of the plant.
Sapling	Refers to a plant grown from a vegetative part of the original plant asexually.
Scaffold	Main branch that forms the structure of an open center tree.
Scion	A short piece of twig or bud with attached section bark inserted into the stock.
Seedling	It is a plant grown from seed.
Shoot	The growth that emerged from a bud in the current growing season.
Spur	Short twig that is specialized for bearing flower buds and fruit on many fruit species.
Stock	It is a plant or root system to which a scion is grafted or budded.
Sucker	A shoot grown from the crown or roots of the tree below the graft union or surface.
Waterspout	It is a vigorous, current season shoot, which is growing un-branched from a primary scaffold or smaller branch.

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