

PART 1: Arboriculture

Chapter 3

Propagating fruit trees

Introduction

There are two **primary modes** of plant **reproduction** in nature: **sexual reproduction** through **seeds**, which generate new plants after dispersal, and **asexual reproduction** through roots and underground organs, where lateral shoots develop into independent plants or shrubs. However, the success rate of these methods can be limited, especially due to the rarity of **optimal conditions** or the **age of the parent plant**. Furthermore, **environmental factors** can sometimes **hinder seed** production. As a result, **humans** step in to assist nature, ensuring the survival and **propagation** of plant species. Gardeners employ **artificial vegetative propagation techniques**, such as **grafting**, **layering**, and **taking cuttings**, to increase offspring **numbers** and preserve the desired traits of plant varieties.

Methods of Propagation

Sexual reproduction

asexual reproduction

Sexual reproduction

This agricultural method involves using **available seeds** to grow **new plants** of the **same species** from which they were collected.

- Seeds should be harvested once they reach maturity, as this is essential for successful sowing.
- Seeds are best harvested and handled
- in good, dry weatherSeed farms employ teams of specialized "collectors"
- The strength of the next generation depends on the quality of the harvest
- Strong, healthy parent plants ensure the production of offspring with desirable traits, maintaining the variety's purity.

A. Factors influencing germination:

- **Pollination:** In dioecious plants, such as date palms, seed production depends on manual pollination between male and female plants.
- **Storage conditions:** Moisture is the main enemy of seeds. After drying, cleaning, sorting and packaging in labelled bags or boxes, the seeds must be stored.
- **Germination rate:** It is difficult to determine the exact **germination time** as this depends on various factors, including the condition of the seeds at harvest, storage conditions, temperature, the age of the mother plant and the environment.

A. Seed treatment and storage:

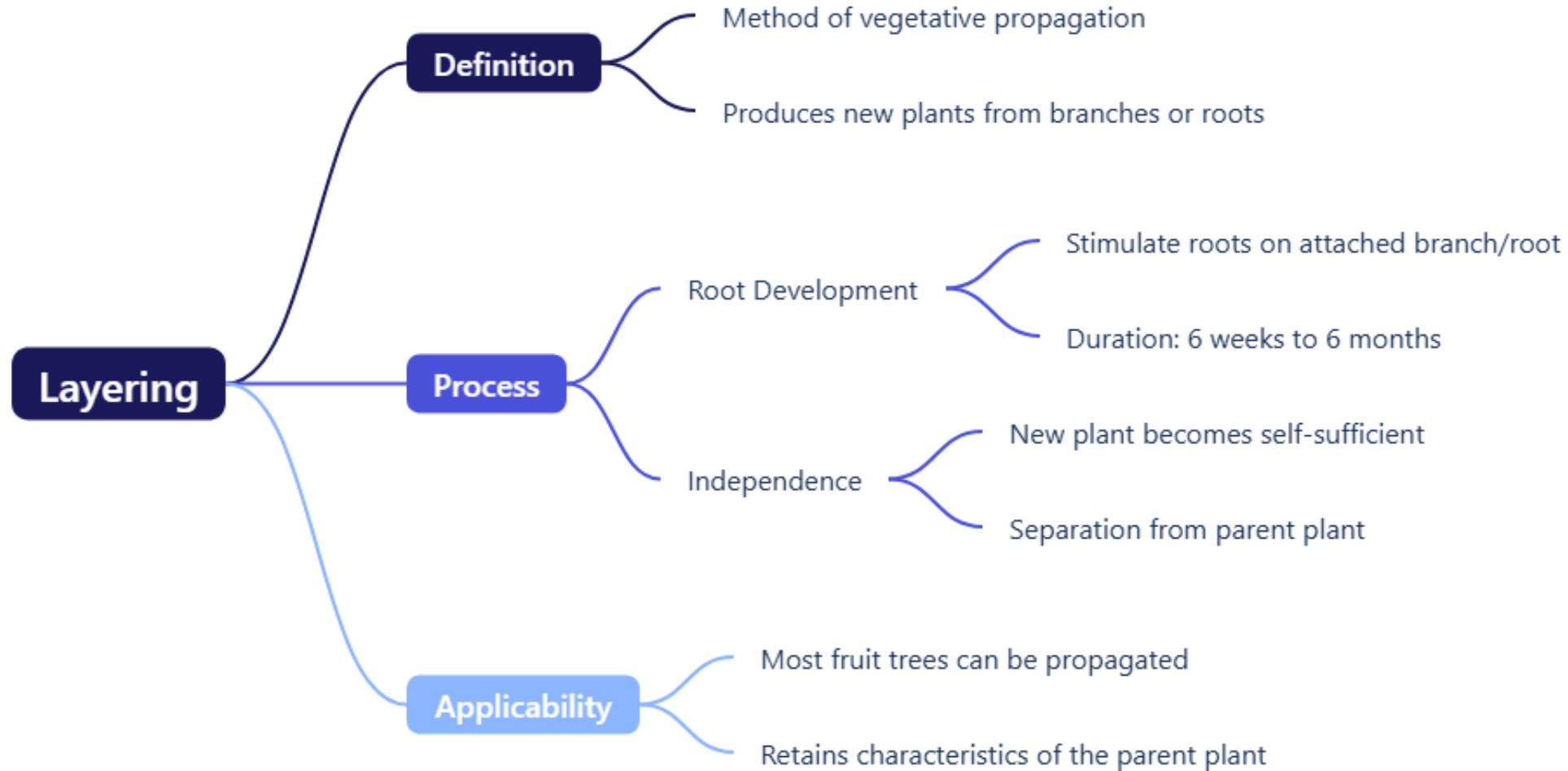
- **Fresh seeds (from citrus fruits, for example):** Sow them immediately in spring in a sunny spot. Germination will begin quickly, within about two weeks.
- **Seeds from firm-fleshed fruits such as apples, pears, grapes and stone fruits:** Spread the pulp out, expose it to the air, clean it, and then separate the seeds. Seeds with hard shells (such as cherries, peaches and apricots) should be stored in a cool, dry place mixed with light potting soil to soften the shell and ensure germination. This process is preferable to opening the shell, as this can damage the seed.
- **Conifer seeds (fir, pine):** Pick pine cones before they fall and dry them to release their seeds.
- **The cones of some species (such as the stone pine) germinate slowly.** Rice and pine seeds take 18 months to mature and the cones remain on the trees for a long time.

A.3. Seed stratification

Stratification is an essential **temporary storage** step for seeds between **harvest** and **sowing**. It **preserves** their **germination capacity** and **stimulates** slow or **delayed germination**, particularly for hard, fibrous, or starchy seeds that attract rodents (such as nuts, acorns, and almonds).

Stratification involves **arranging the seeds** in successive layers and **covering them** with a moderate amount **of soil**. They should then be stored in a place that is protected from **drought** and **frost**.

Asexual reproduction



The Importance of Layering

Layering is a reliable method for:

1. **Propagating sterile** العقيمة varieties or those that lose their characteristics when grown from seed, such as certain hazelnut البندق tree varieties.
2. Propagating species that are **resistant** to cuttings, such as *trembling aspen*.
3. Propagating species that are difficult to graft, such as mulberry. التوت

Care of Mother Plants (for Propagation)

Selection — Strong and healthy mother plants

Growing Conditions —
— Optimal conditions
— Low density for layering

Pruning —
— Remove unused branches
— Limit sap flow by removing unpruned shoots

Maintenance during Growing Season —
— Pruning — Thin and prune as needed
— Watering — Regular watering
— Weeding — Remove unwanted plants
— Pest Control — Spray insecticides

Resting Period — Allow full season rest to avoid overworking

Types of Layering

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graph TD; A[Types of Layering] --> B[1. Underground or Bud Layering]; A --> C[2. Air Layering]; B --> D[- Simple Layering]; B --> E[- Compound Layering]; B --> F[- Improved Mound Layering];
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1. Underground or Bud Layering

2. Air Layering

- Simple Layering

- Compound Layering

- Improved Mound Layering

1. Underground or Bud Layering

A) Simple layering

In this method, rooting is stimulated from a single point within the layer.

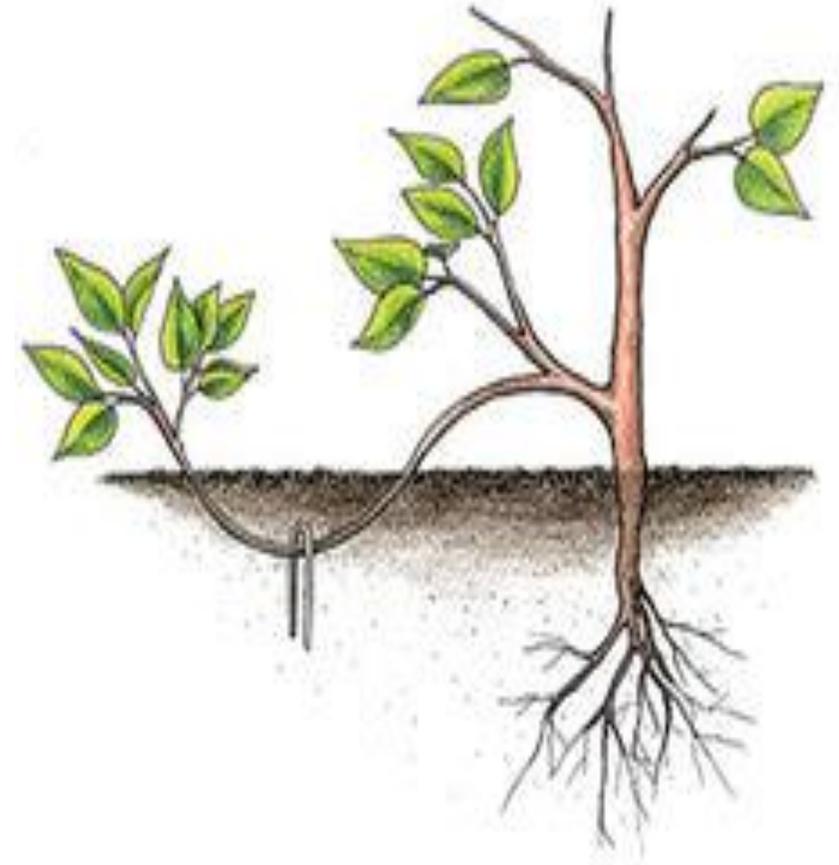
- Select a branch close to the ground and bend it until it **touches the soil** or the surface of a **pot** filled with soil.
- About 30 cm from the tip of the branch, make a **5 cm** cut that penetrates the branch without cutting it completely.
- Apply **rooting hormone** to the cut to encourage root growth.
- **Secure** تثبیت the branch in place with a hook, wire or stone, ensuring the cut remains in contact with the soil.

SIMPLE LAYERING



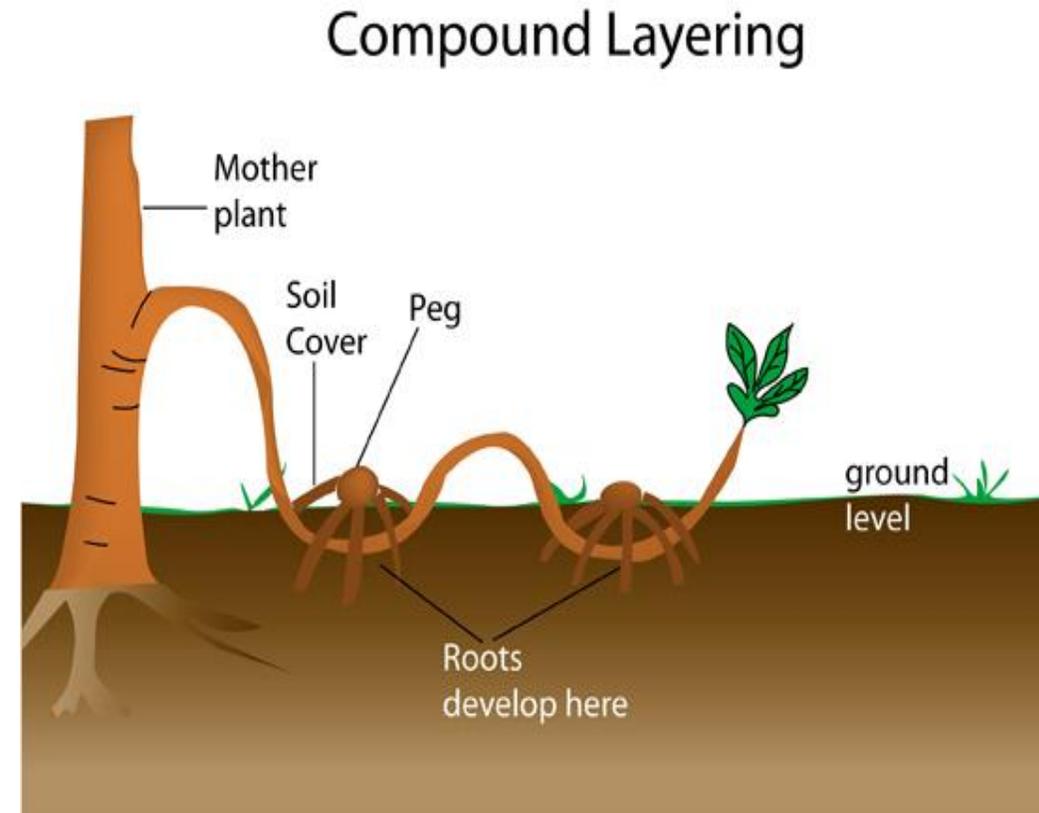
- Cover the **cut with soil** or another moisture-retaining material to form a mound. Leave the tip of the branch exposed. If desired, make a **7.5 cm deep hole** حفرة and insert the cut end of the branch into it before covering with soil.
- Water the plant well.
- Cover the mound with leaves or moss to prevent it drying out too quickly الجفاف.
- Water the plant regularly.
- Once the cutting has formed roots, cut it from the parent plant and leave the new plant in the same place for a week. This allows the new plant to **recover** التعافي **from the separation.**
- After a week, transplant the new plant to its desired location.

SIMPLE LAYERING



B, Compound Layering

- This method is similar to **simple layering** but allows the production of a **large number of seedlings** in a short period.
- The short stem is bent completely **downward** and buried in the **soil several times**, ensuring that the **tip remains above the surface**.
- The stem should be kept moist الرطوبة to encourage the formation of new seedlings.
- This method is commonly used for **apples, pears,** and walnuts الجوز to produce a large number of seedlings.



C, Improved Mound Layering

- An advanced propagation technique, especially for fruit trees like apples, widely used in Spain.
- Based on the principle of “strangulationالخنق” to stimulate the production of natural rooting hormones.
- Metal wires اسلاك are placed under slits in the branches, which are then treated with rooting hormones.
- This traps and concentrates auxins (growth hormones) at the incision site, promoting rapid development of a strong, dense root system.

Steps of the method:

1. Stimulating the mother plant:

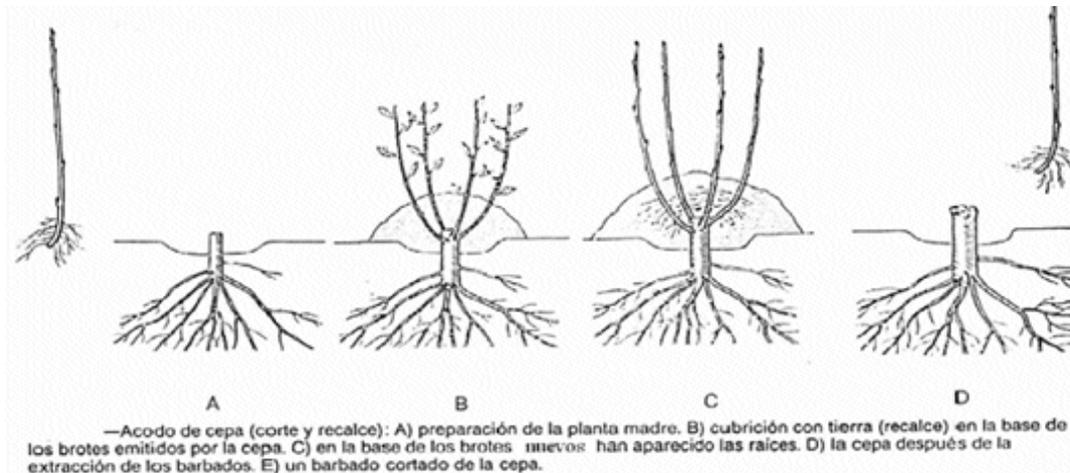
1. Cut the plant near the ground during the dormant season.
2. This encourages the production of new, strong side branches from the base.

2. Wounding and strangulation:

1. Once new branches grow to about 30 cm, remove leaves from the lower part of the branch.
2. Make two simple longitudinal شقيين incisions in the bark using a sharp knife and apply rooting hormone.
3. Tie a metal wire tightly around the branch just below the incision. اسفل
4. The wire compresses the vascular tissue, preventing auxins and nutrients from returning to the roots, forcing root formation at the incision site.

3. Covering the wounded area:

1. Cover the “strangled” and wounded section with **fertile soil** or **peat moss**.
2. Strong, dense **roots form** at the incision due to the high **concentration of auxins**.
3. By winter, multiple branches (around 10) will have their own strong root systems.



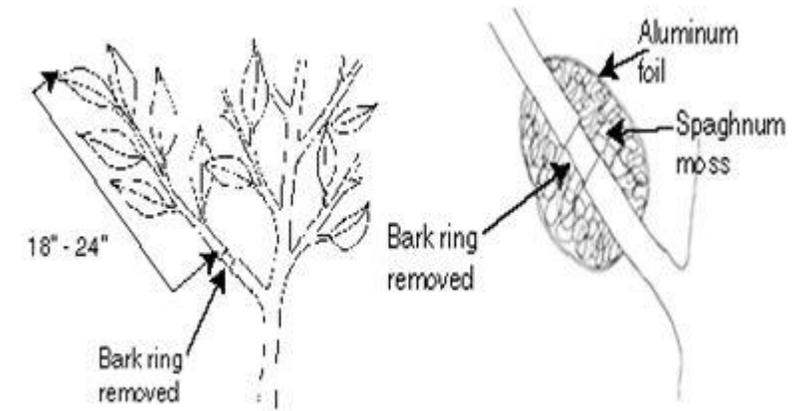
2. Air Layering

•Branch preparation

- Select a healthy branch and clean an area about **30 cm from the tip**.
- Remove leaves and side branches from a **7–8 cm section around the node**.

•2. Incision and hormonal stimulation

- Make **two parallel circular cuts** around the branch, **2.5–4 cm apart**.
- Remove the ring of bark between the cuts to expose the **white wood**.
- Carefully scrape off the **cambium layer** (the green layer) to prevent the bark from healing.
- Apply **rooting hormone** to the **upper edge of the incision**, where roots will form.



•3. Preparing the rooting medium

- Soak a generous handful of **peat moss** in water, then squeeze out the excess so it is **moist, not wet**.

- Wrap the peat moss completely around the exposed area.

- Cover the moss with **plastic wrap or aluminum foil**.

- Secure both ends tightly with string or ties to retain moisture.

•4. Monitoring and separation

- Leave the air layer in place for **6–8 weeks**, until roots clearly fill the moss.

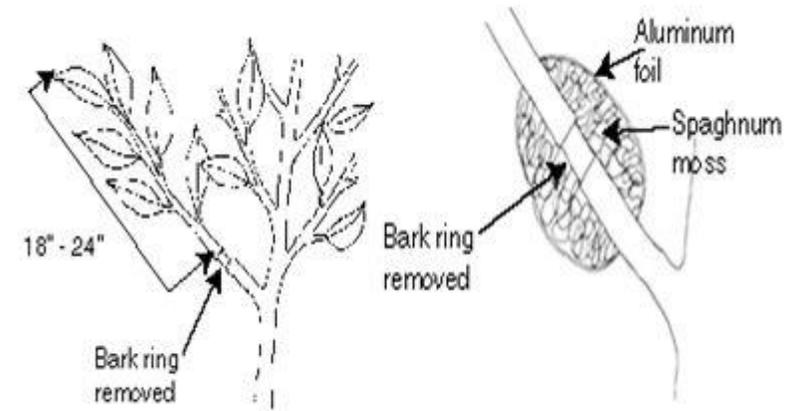
- Once well-rooted, cut the branch **just below the rooted section**.

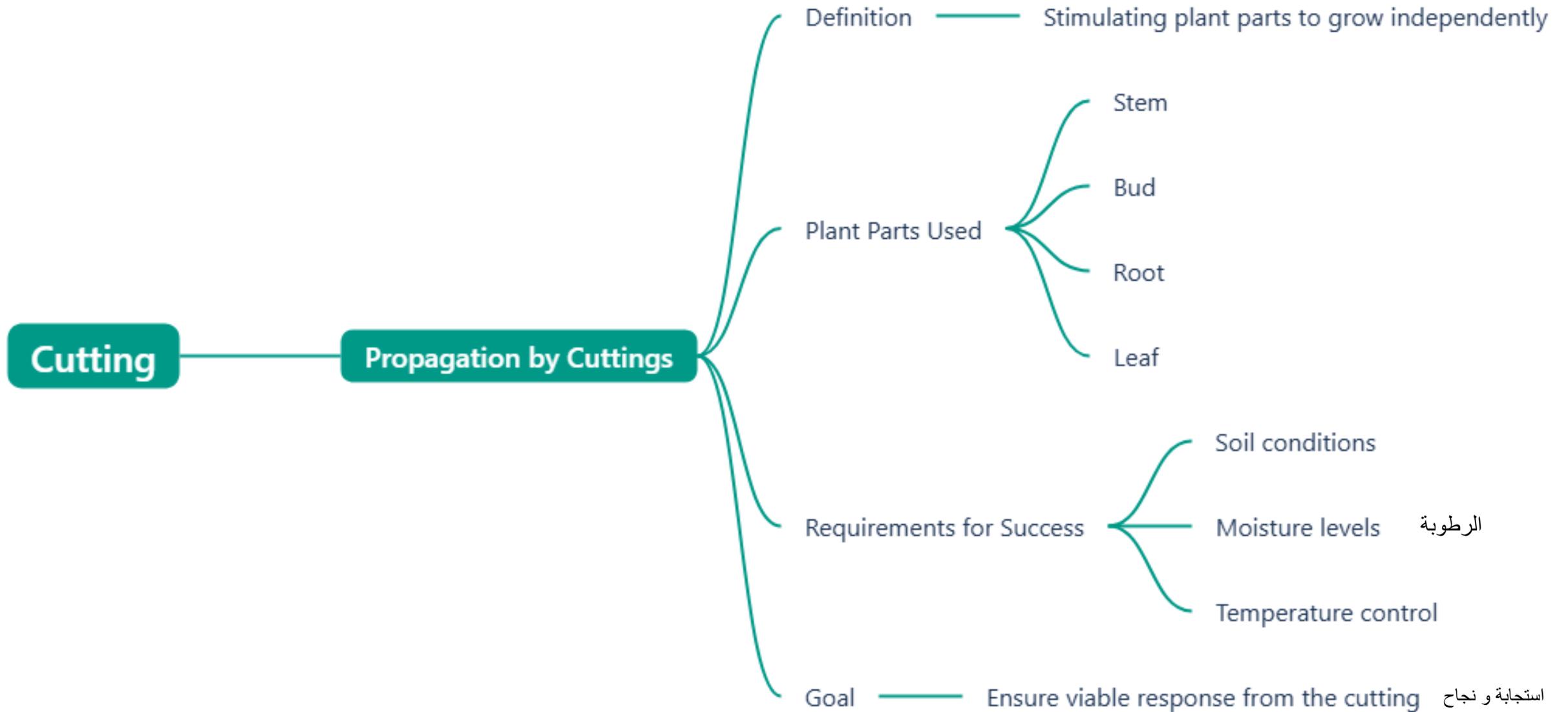
- Carefully remove the plastic covering while keeping the moss intact around the roots.

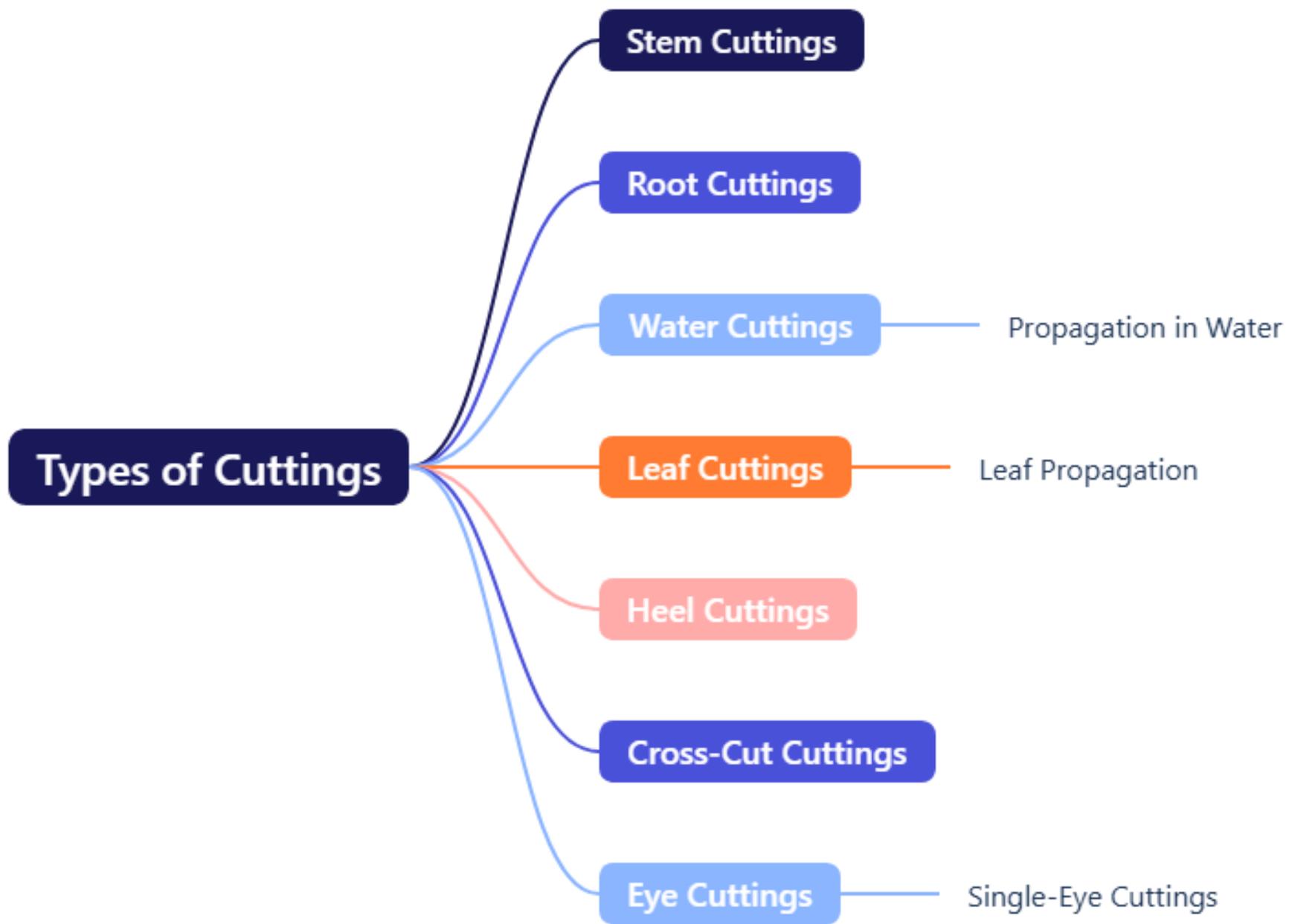
- Plant the new branch in a pot with **suitable growing medium**.

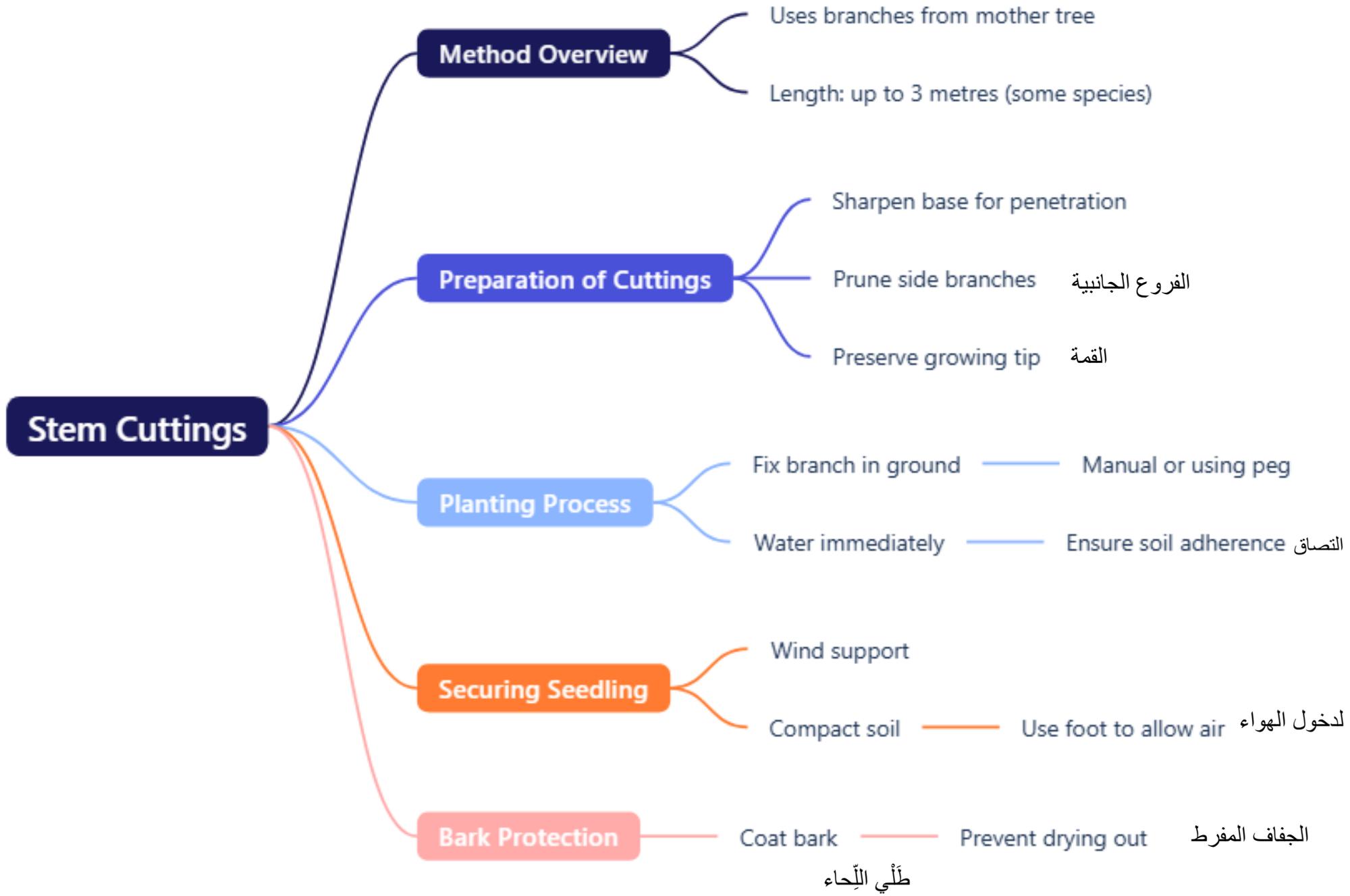
•Note

- This method is similar to the Spanish air-layering technique, but instead of using wire to girdle the branch, the bark is **manually removed** to encourage auxin accumulation and root formation at that specific point.





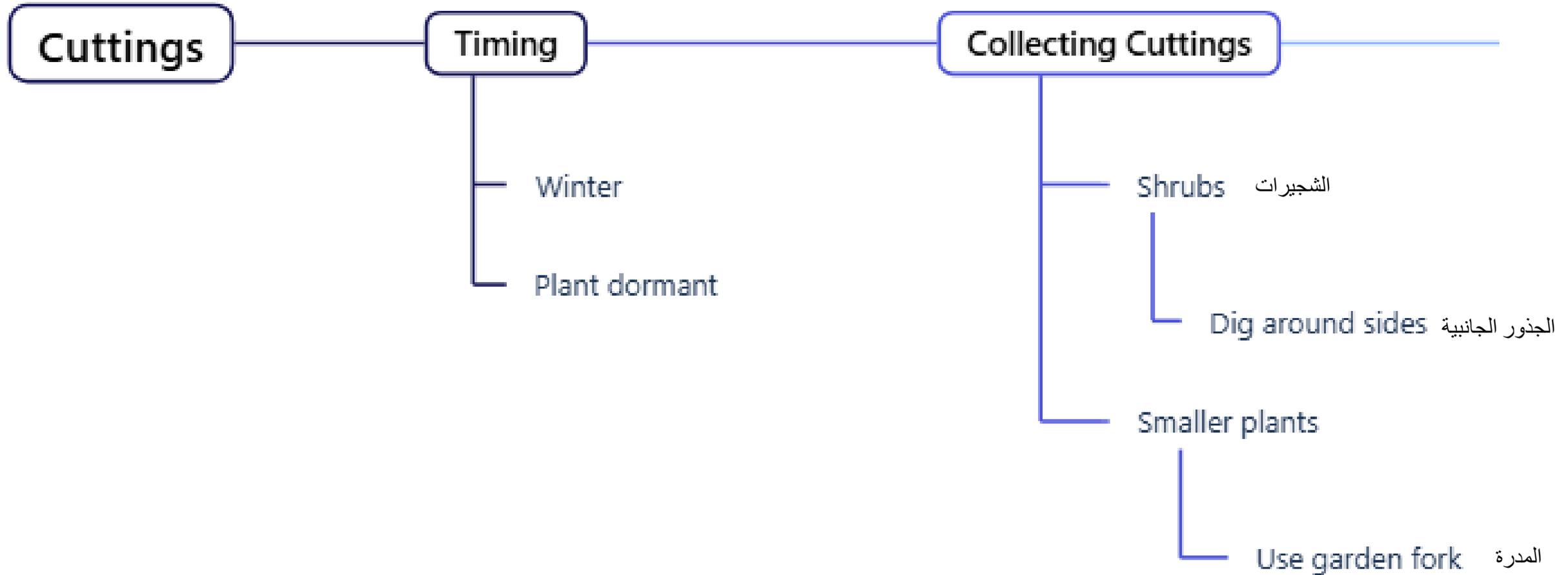




2, root cuttings Propagation

Propagation by root cuttings is an easy and effective way to grow certain types of plants, particularly shrubs, without requiring complex skills. Although this method is simple, it requires caution to avoid exhausting the parent plant. Therefore, it is advisable to take a limited number of cuttings to preserve its strength.

2 root cuttings Propagation



2 root cuttings Propagation

Preparing Cuttings

Pruning shears مقص

Sharp and sterilized

Cut roots into 3-10 cm pieces

At least one bud per piece

Replanting

Cover roots of mother plant

Prevent drying and air exposure
الجفاف

2 root cuttings Propagation





3

Propagation Cuttings in Water

Method

Place cuttings in clean water

Roots appear over time

Timing

Spring

Summer

Suitable Plants

Mint نعناع

Willow صفصاف



4

Leaf Propagation Techniques

Method Overview

Placement — Leaves in center of pot

Plant Varieties — Effective for various plants

Success Factors

Light — Adequate light needed

Heat — Warm environment essential

Water — Sufficient moisture required

5

Heel Cutting

Definition

- Secondary branch cut
- Connection to main branch remains

Purpose

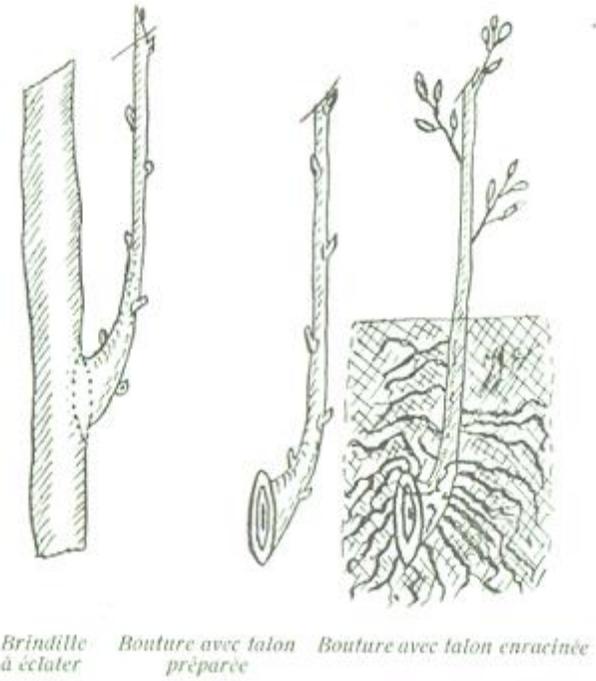
- Suitable area for root formation
- Increases chances of success

Risks

- Potential damage to parent plant

Application

- Used for woody plants
- Timing for cuttings:
 - Spring
 - Late summer
 - Autumn



6

Cross-cut

Definition

Heel cut type قطع الكعب

Retains 1.5 cm section

Purpose

Creates small stick shape عصا صغيرة

Applicability

Useful for slow-to-root plants
تتأخر في التجذير

Suitable for hollow or pithy stems
فراغات أو نسيج إسفنجي

Benefits

Cambium protection

كمبيوم

Shields fragile tissue from pathogens

Timing

Conduct in summer

Preferably at start of autumn بداية



Bouture avec crossette Bouture avec crossette enracinée

7 Eye Cuttings

Definition

- Small branch piece
- Length: 2–5 cm
- Contains axillary bud

Purpose

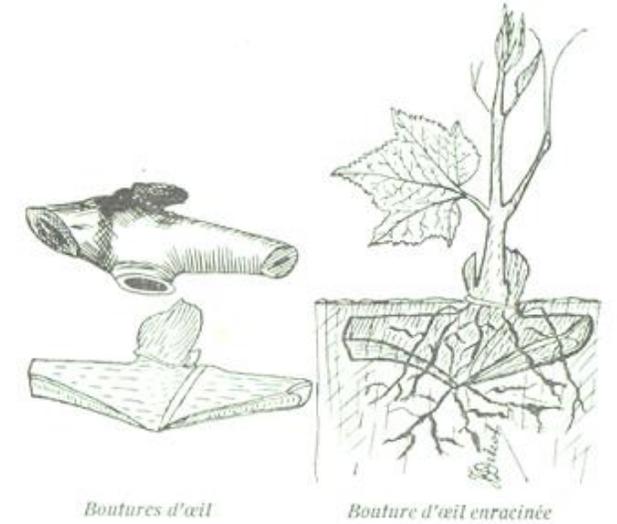
- Obtain multiple cuttings from the same stem
- Develop into new plants

Timing

- End of summer
- Beginning of autumn

Growth Process

- Takes time for cuttings to grow
- Forms a stem from cuttings



3. Division

For perennial plants that grow in 'clumps' or carpets and have been in the garden for several years, dividing them will allow them to multiply and give them more strength. This process aerates the roots and centre of the plants, giving them more space and rejuvenating them to improve flowering.



4

Grafting

Definition

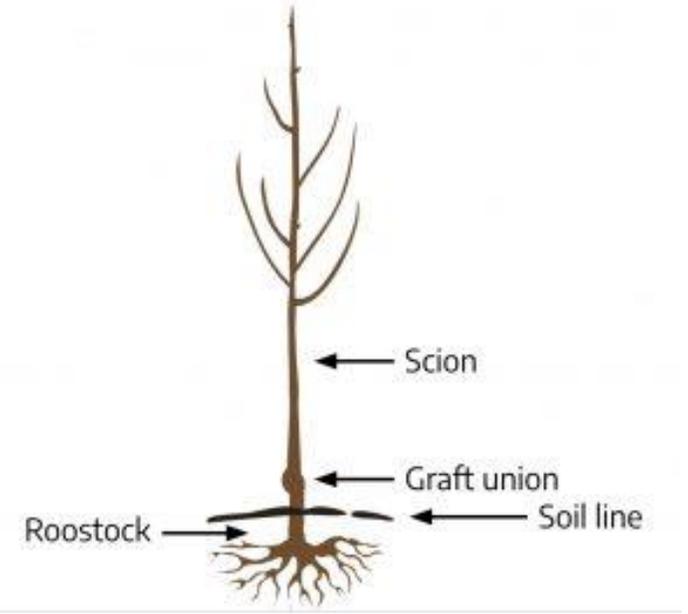
- Propagation process
- Scion and rootstock

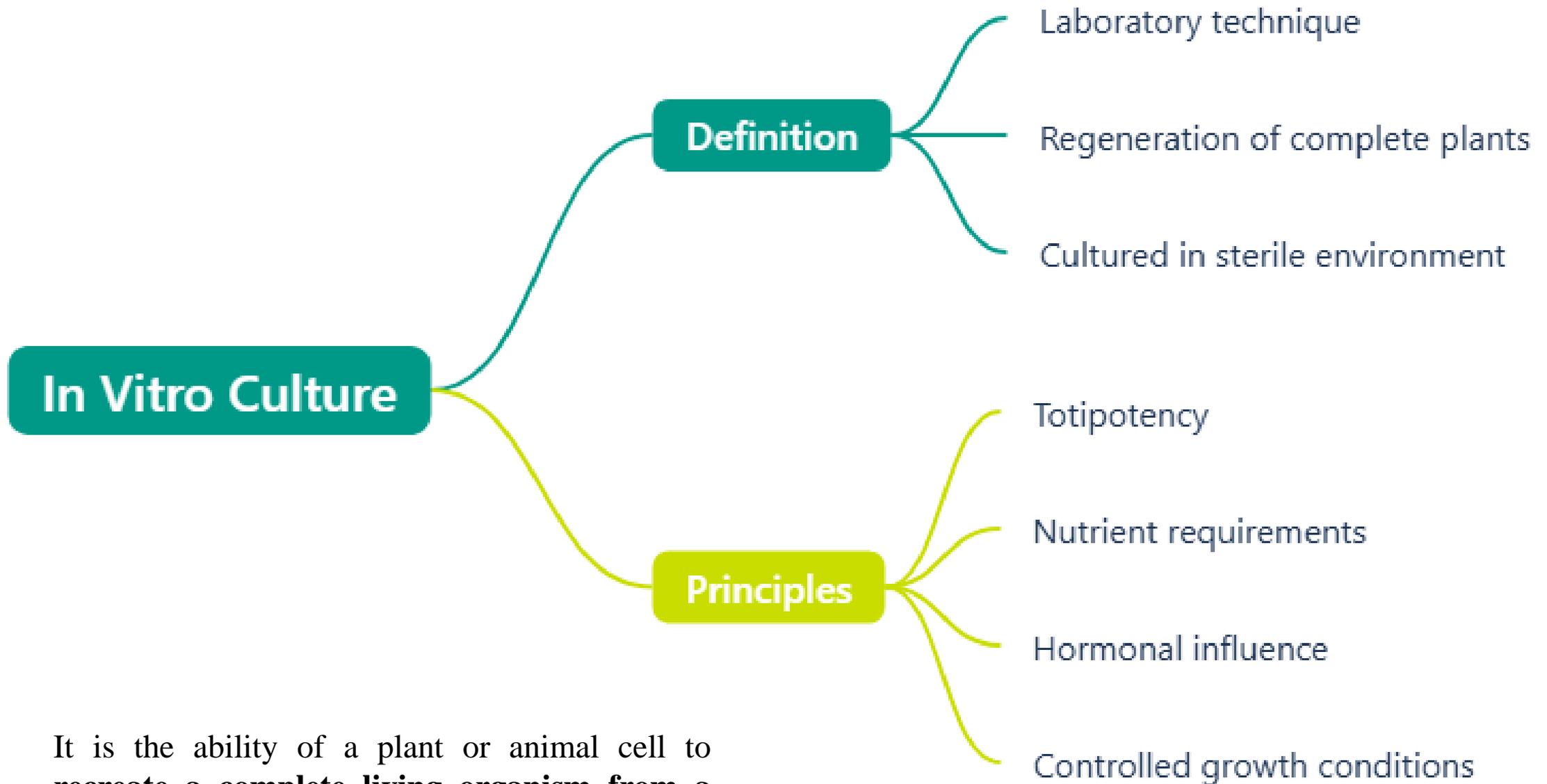
Conditions for Success

- Proximity of parts
- Same plant family
- Similarities in sap and bark اللحاء
- Environmental conditions
 - Moderate temperatures
 - Skilled hands and tools دقيقة

Reasons for Grafting

- Strong, reliable plants
- Disease resistance
- Faster fruit/flower production قزمية
- Development of new varieties
 - Increased fruit yield
 - Insect resistance





It is the ability of a plant or animal cell to **recreate a complete living organism from a single cell.**

In Vitro Culture

Applications

Micropropagation

Producing genetically identical plants

Small tissue samples (nodes/buds)

Similar to grafting

Meristematic Culture

Uses undifferentiated cells

Forms all plant tissues

Produces virus- and disease-free plants

Somatic Embryos

Development from cultured cells

Importance in plant propagation



Thank you
for your
attention