

2. Creation of a fruit tree nursery

2.2. Introduction

A nursery is a place or plot of land reserved for the production, propagation, and cultivation of plants until they are ready to be planted elsewhere. In nurseries, woody plants (particularly trees and shrubs), hardy herbaceous plants (perennials), and vegetable plants are grown. Nurseries can be classified according to:

- **Type of production:** specialized nurseries, mixed nurseries that simultaneously produce forest, fruit, and ornamental seedlings, and general nurseries that produce a wide range of fruit trees, ornamental trees, shrubs, and climbing plants, requiring cycles ranging from three to eight years.
- **duration of existence:** Mobile or temporary nurseries are small and located near cultivation areas to avoid large investments and transportation costs, ensuring successful cultivation. Permanent nurseries are considered seedling production factories and require large investments to meet the continuous cultivation program for a large area.
- **Depending on their function** Propagation, nurseries reproduce and multiply all species and varieties and supply nurseries with young seedlings. Nurseries grow young seedlings from propagation nurseries until they reach a marketable size.

A nursery is a piece of land devoted to cultivating and preparing useful trees and ornamental plants. It is often an isolated plot of land, but sometimes it is a large establishment.

2.2. Conditions necessary for the success of a nursery

2.2.1. Site selection:

a. Access

The nursery must be easily accessible by road to allow for the easy delivery of necessary products (sand, manure, fertilizer, etc.) and convenient shipment of plants.

- Employing a relatively large workforce.
 - The nursery should be located near population centers.
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 - It is not advisable to locate the nursery in a low valley for fear of flooding.
- b. **Ground slope:** flat land should be chosen if possible to avoid costly leveling work (optimum slope 0.5–3%).

- c. **Texture and structure:** the soil should be neither too clayey nor too light. The soil must be deep; if not, this must be remedied by digging or subsoiling (1 m) to improve soil permeability by enhancing natural drainage and horizontal capillary water circulation and combating plow pan. Chemical quality is less important as it is easy to remedy.
- d. **Water supply:** the water must be neither magnesium-rich nor salty. The volume required varies depending on the species grown and can be estimated at an average of 50 m³/ha/day. Preferably, the water supply should be natural, flowing directly from a wadi or canal, otherwise a well must be dug.
- e. **Shelter:** Young plants must be protected from bad weather, ridges and areas where the wind often blows, such as near the sea. A north-facing aspect is best, and windbreaks should be created. Protection against excessive heat must also be provided.

2.2.2. Human Resources:

In order to run a nursery, it is necessary to have qualified and available staff. Management is essential for the proper organisation of work. Depending on the size of the nursery, this role will be filled by a water and forestry technical officer, a technician or a forestry engineer (for forest nurseries), or an agricultural engineer (for vegetable or arboricultural nurseries). Seasonal and temporary agency workers are recruited as needed for large-scale work that does not require any particular qualifications.

2.2.3. Other considerations:

It is important to consider the following:

- Materials for preparing substrates (e.g. sand, manure, soil, poles and straw) must be available near the site.
- Future expansion in case the reforestation programme grows.

2.3. Organising the nursery

Once the site has been selected and production determined, the necessary elements for plant production must be put in place.

Setting up a nursery involves organising the space available and making judicious choices regarding the location of various facilities and buildings (stores, offices, production areas, etc.) to optimise production and reduce costs

To successfully set up a nursery, the following points must be considered:

- The annual quantity of plants to be produced
- The production techniques adopted (in containers or bare-root)
- The location of basic infrastructure (storage, water source, irrigation system, cold storage, roads, etc.)

2.3.1. Determining the boundaries

The size of the nursery should be directly proportional to the annual production volume, the types of trees planted, the techniques used and how long the trees remain in the nursery. It is recommended that the productive area is defined and an organisational plan is put in place to facilitate the execution of tasks.

If the nursery is located near a dam or watercourse, the limits of the water's advance during flooding periods must be considered.

2.3.2. Preparing the land:

If the land is wooded or abandoned, it may be necessary to remove roots, clean the land and level the ground. The land must be levelled if it is uneven or has slight slopes. If there are steep slopes, the land can be prepared in terraces with extreme caution and without removing the fertile topsoil.

2.3.3. Trails: Generally speaking, the nursery will be served by a network of trails providing access to various locations within the nursery. This network includes:

- Main paths, 5–6 m wide, for vehicles, etc.
- Secondary paths, 2–3 m wide, for wheelbarrows, carts, etc.

The path network could make it possible to complete a tour of the nursery. Generally, this network represents 10% of the nursery's surface area.

2.3.4. Fences and windbreaks:

In a nursery, it is preferable to have a permanent fence that prevents access by domestic and wild animals (especially game). This can be supplemented later by one or more rows of windbreaks. These can have a mechanical or physical function, reducing wind speed and decreasing its harmful effects, such as plant drying and the risk of sand accumulation. They can also have a biological function, promoting the creation of a microclimate with a lower average temperature and reduced evaporation.

The characteristics of the species used for windbreaks are as follows:

- Good adaptation to the soil.
- Rapid growth.
- Good anchoring with a deep taproot system.
- Evergreen species
- Low water consumption (a willow consumes approximately 100 m³ of water per year).

Windbreaks:

Wind can damage crops, especially container plants. There are two types of windbreak:

A. Plant windbreaks:

The main disadvantage of a windbreak hedge is that it takes a long time to establish. However, the low installation cost of plant windbreaks, especially when using young plants, means they are almost always preferred to artificial windbreaks.

- ⇔ It blocks dry, hot summer winds, protecting animals, crops and people.
- ⇔ It increases agricultural production (crops and orchards) by mitigating the harmful effects of wind, which can result in a potential production loss of 20% or more.
- ⇔ It enables the cultivation of sensitive crops such as tomatoes and sweet potatoes.
- ⇔ It reduces wind erosion and promotes the formation of more resilient soil (less dry and more covered).
- ⇔ It promotes snowmelt in winter by capturing snow on its exposed side.



Fig.1. Plant windbreaks. <https://www.freshplaza.fr>

⇔ **Principles of Optimal Design**

- **Orientation:** To be most effective, the hedge should be planted perpendicular to the prevailing wind direction.
- **Height and density:** It should be as tall as possible and reasonably dense to ensure good protection.
- **Year-round protection:** For year-round effectiveness, the hedge should mainly consist of evergreen trees and shrubs with evergreen foliage.

⇔ **Air Flow Management (Filtration vs. Blocking):**

- **Gradual deflection:** The wind must be deflected gradually. Plant low shrubs in the front row on the windward side, followed by taller plants.
- **Avoid sudden blockage.** Avoid an abrupt break in the line of tall plants, as this could increase the wind force further away from the hedge.
- **Necessary filtration:** The hedge should filter the wind, rather than block it completely. The aim is to allow 20–40% of the wind to pass through. Total blocking would create harmful disturbances and friction on the sides of the protected area.

- **Length of the protected area:** For an effective filtering hedge, the protected area extends over a distance equivalent to 10–15 times the hedge's mature height (H). Example: A 10-metre-high hedge can protect an area extending 100 to 150 metres behind it.

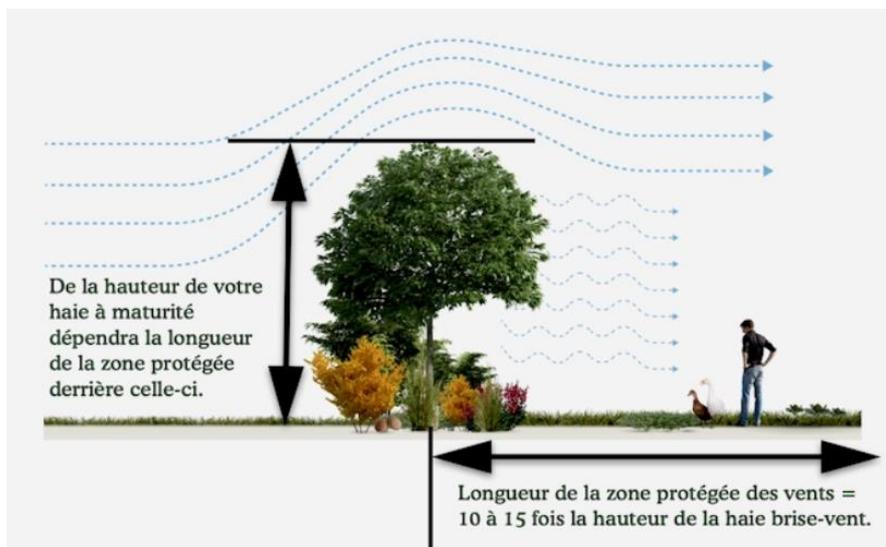


Fig. 2. Length of the protected area. <https://www.permaculturedesign.fr>

When choosing species for your windbreak, you need to balance wind protection with productivity.

Wind resistance and turbulence: The species must be either wind-resistant or tolerant. It is important to choose plants that do not block the wind too much, in order to avoid turbulence (which can cause further damage) and to allow small air movements that help to prevent frost.

Added productivity:

Select plants

- Select plants that provide an additional harvest, such as wood, fruit or nitrogen fixation, to increase the productivity of the windbreak.
- Avoid trees that require a lot of water, such as poplar or willow, if they are likely to compete with nearby crops for water.
- **Local inspiration:** Observe the surrounding nature to identify local strategies and species that fulfil these roles, and try to imitate them.

- **Structure and height layering:** Consider the different heights that your trees and shrubs will reach at maturity in order to create effective layering.

Windbreak Zone	Mature Height	Recommended Species Examples
Most Windy Zone (Front)	Low, resistant shrubs	Pioneer species: gorse, broom, juniper, sea buckthorn, dogwood, laurel, spindle tree, holly, viburnum, hawthorn...
Intermediate Zone	Small trees (7 m to 15 m)	Cherry trees, apple trees, hazelnut trees...
Rear Zone	Large trees (> 15 m)	Wild cherry (merisiers), black locust (robiniers), acacias, ash trees, oaks, conifers, chestnut trees, beech trees, service trees (cormier)...

B. The main advantage of artificial windbreaks is that they are operational immediately after installation. Other advantages include the fact that they require no maintenance and do not compete with plants for space. However, this equipment is not widely used in nurseries.

2.3.5. Preparing the soil in the nursery

The soil is always needs to be cultivated beforehand. If it is poor quality or lacks certain substances, the first thing to do is improve it.

- **Light and dry soils** can generally be improved with manure, sewage sludge, plant fertilisers, mulch, watering and proper irrigation. The paths should be higher than the beds. Deep digging allows rainwater to penetrate the soil more easily, creating valuable reservoirs for dry periods. It also enables the roots to spread over long distances underground, thus escaping the effects of excessive heat.
- **Very wet soils** require drainage measures such as drainage pipes and gravel paths below ground level, as well as repeated digging and hoeing in hot weather.

- **Compacted soil** requires careful loosening based on the condition of the lower layers; frequent ploughing in each season and the use of manure, wood ash, coal ash, slag and sand will produce good results.
- **Land whose topsoil** has been depleted by previous crops but whose subsoil is not to be disregarded requires loosening to bring the subsoil to the top and the topsoil to the bottom.

2.3.6. The source of the irrigation

Rainwater is the best type of water for irrigating nursery plants, so it is important to collect it wherever possible and deliver it to seed beds and areas where seedlings are germinating.

Next comes water from rivers and streams, followed by water from ponds and swamps with muddy bottoms, which result from fallen leaves, root growth and the activity of aquatic plants. If the nursery is large, or if the climate or type of cultivation requires frequent watering, water can be a dam, stream, well or borehole.

2.3.7. Nursery enclosure.

In open fields, nurseries are rarely enclosed, but an enclosure becomes necessary if they are important or exposed to passers-by, hunters, intruders or livestock, or if they are adjacent to dwellings.

We accept walls, provided they do not significantly impede air currents or concentrate excessive heat. Although they are expensive to build, they enable us to grow trees in a trellised form and to collect peaches and grapes. The presence of a natural watercourse or artificial ditch around the nursery provides the additional advantages of water for irrigation and drainage of wet soil.

Preparing seedlings:

The best seedlings are small and strong with sturdy roots. These conditions are achieved by planting them sparsely in loose soil or transplanting them at the embryonic stage. Transplanted woody seedlings are best when they are still small and strong with soft bark; otherwise, seedlings from the current year are preferable.

They should be dug up in early November, once the sap flow has completely stopped. Hand digging is not as effective as using a tool that loosens the soil and lifts the seedling while pulling it out quickly. Once uprooted, the young seedlings are planted in a partially shaded spot close to the plot where they will be grown, with the appropriate distance kept between them. We press the soil around each seedling with our feet, add more soil and water well.

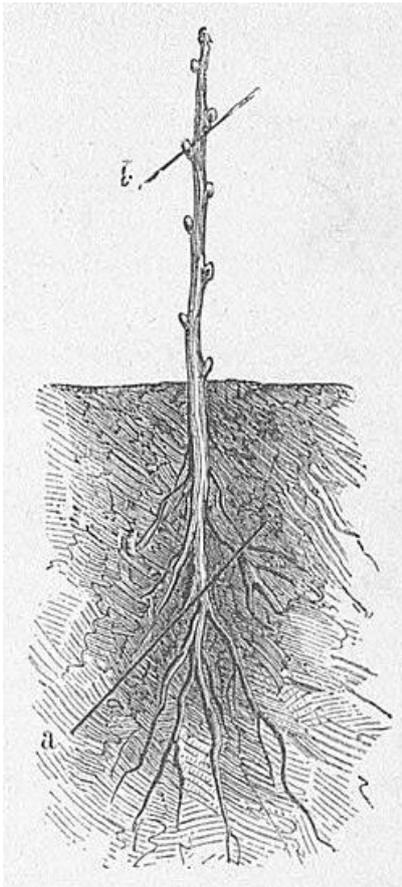


Fig.2 : Pruning a young seedling. Before planting the seedling in its final location, pruning is usually necessary, although there are some exceptions. *This involves removing any long, dry or damaged roots and cutting the stem to 0.25 metres from the root collar if the seedling is intended for grafting and to 0.10 metres if not. In any case, it is preferable to prune the top to 0.25 metres.*