Economic role (nursery production)

- 5 mln of grafted cypresses + as many from seeds are sold per year in the Mediterranean countries; increasing trend.

- Pistoia nurseries (30% of the national production, 80% of the regional production):
  - Cupressaceae = 18% of the entire production;
  - Export in the Mediterranean countries: France, Spain, Greece; but also CH, UK, NL, Austria and extraeuropean countries as well.
Common cypress (Cupressus sempervirens): monoeccious species =

Male and female strobili are separate on a same plant.

Reproductive cycle

**Year 1**
- **Initiation** of flower buds: late spring or early summer;
- **Differentiation**: male cones in spring, female cones in autumn;

**Year 2**
- **Flowering** (pollination): January-February
- **Fertilization**: May-june;

**Year 3**
- **Seed maturation**: autumn (18-20 months from pollination) → **harvest of cones**;
- **Opening of cones**: November-December (20-24 from pollination).
After maturation

- Harvest of cones;
- Drying: in the sun or in kilns at 35-40° C;
- Screening: through a sieve to exclude smaller seed (empty).
- Sowing

Germination capacity of cypress seeds is low because the percentage of filled seeds is low (FS: 15-25%)  
Germination capacity on filled seeds (GCF): 75-90%
Germination capacity on total seeds (GCT): 12-18%.

Preparation of seed for sowing (pregermination) generally is not needed for common cypress (seeds are moistened in water for 2-3 days).

Stratification at 1-2°C and 100% UR increase the percentage and speed of germination.
Sowing: from March to May

Density: 300-600 seedlings per square meter (from 3000 to 4500 seeds per square meter);

Covering of seed with a 1.5 cm thick layer of sand and peat (1:2 in vol.)

Protection against dry, washing away, cold, birds and weeds by applying a shading net;

Success of sowing: number of viable seedlings 8-10 months after germination;

Sowing can be anticipated by using heated seedbeds with spray lines.

Transplanting into pots containing mould, sand and perlite (3:1:1) after some months (3-4).

Cure colturali: waterings, weeding and health-care measures.

After 1 year seedlings are 20-30 cm tall and can be transplanted in larger pots or in the field.
Production of cypresses seedlings for reforestation

By law new forest plantings must be done using seed obtained from the seedstands included in the LNBS (since 2003 this subject is under regional competence and there is the RRMFB);

Cones are harvested by skilled workers;

The extracted seed is sieved and sent to forest nurseries;

Young plants are transplanted in pots or in the field and are added with a certification of origin.

Today is possible to realize clonal orchard with resistant genotypes for the production of improved seed.

Seed-production stands: main traits

1) Native or naturalized stands are preferred;

2) Stands that have extent, age and structure ensuring a good cross-pollination and an abundant fructification;

3) Good morphological traits evenly distributed within the stand: straight stem, thin branches (self-pruning), bark thickness ecc.;

4) Production, related to site conditions and to wood technological properties;

5) Presence of vigorous and disease-free trees. Moreover, the distribution area must taken into consideration in order to include different environmental conditions, and particularly extreme climatic and soil conditions reflecting tolerance to specifica environmental stresses (drought, wind, snow, ecc.).
Pros and cons of obtaining plants from sexual reproduction

**Pros**
- Higher genetic variability among seedlings, higher flexibility and adaptation;
- Greater potential concerning resistance to biotic and abiotic stress factors;
- Plants from seed are suitable as rootstock and for forest plantings;
- Lower production costs.

**Cons**
- Seedlings don’t maintain useful parental traits: e.g. growth rate, habit, resistance etc.;
- Crown shape of the offspring is not even;
- Not suitable for ornamental purposes;
- Less suitable for windbreaks;
- For certain soils the use of tolerant clonal rootstocks (obtained by self-rooted cuttings) is better;
- Inbreeding depression of seedlings if seed is obtained from few near tree.

Production of cypress plants by grafting

**Pros**
- Mass production of selected genotypes;
- Replication of genotypes (maintaining traits of the mother tree);
- Even phenotype in a same site;
- Suited for ornamental and windbreak plantings;
- Good compatibility between grafted clone and rootstock from seed (90% success);
- No significant effect of the rootstock on the growth rate, shape, foliage colour, resistance of scions.

**Cons**
- No genetic variability: risk due to the large-scale spread of few clones;
- Problems with adaptation to different environmental conditions;
- Problems in case of susceptibility of clones to newly introduced pathogens.
Propagating cypress by grafting: procedure

- Sowing in January in heated seedbeds;
- Transplanting in June of seedlings in pots;
- Growing in pots (larger dimensions) for 1-2 years;
- Rootstock are grown in heated greenhouse (grafting from January to spring);
- Scions are collected in January-February (apical shoots 10-15 cm long collected in the upper outer part of the crown are preferred);
- Grafting methods: side-veneer, is the most successful technique; few cm above the collar; close cambium contact is provided between the two parts, the graft is securely attached with non-vulcanized rubber and protected with specific mastic;
- Grafted plants are grown in controlled conditions (22°C e UR 100%)
- At the beginning of the growing season the stock is topped (to ensure a better growth of the scion); then the stock is cut back above the scion in gradual stages.
- Transplanting of the grafted plants in (4-5 l) pots in May and growth for 2 years (h 100-150 cm). One year later the graft point is no longer visible.

Grafting phases

![Grafting phases](image-url)
Production of Cypress Plants: Methodologies and Aims

From grafting to real cypress

Pros
- Propagation of selected genotypes;
- Replication of a genotype;
- Even phenotype in a same site;
- Selection of clones tolerating particular kind of soils;
- Selection of clonal rootstock tolerating a certain soil that can be used for grafting clones with other useful traits;
- Avoidance (eventually) of the rootstock effect on some useful traits (growth rate, resistance).

Cons
- This technique is more expensive, problematic and time-consuming than grafting;
- Cuttings must stay in the bottom-heated bench in the greenhouse for long;
- Greater health-care control (more expensive);
- Greater problems and longer time during the hardening phase;
- Mean yield lower than grafting (from 30 to 80% depending on the year and genotype).

Production of cypress plants by cuttings

Pros
- Propagation of selected genotypes;
- Replication of a genotype;
- Even phenotype in a same site;
- Selection of clones tolerating particular kind of soils;
- Selection of clonal rootstock tolerating a certain soil that can be used for grafting clones with other useful traits;
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- This technique is more expensive, problematic and time-consuming than grafting;
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- Greater health-care control (more expensive);
- Greater problems and longer time during the hardening phase;
- Mean yield lower than grafting (from 30 to 80% depending on the year and genotype).
Phases of propagation by cuttings

Mother plants are selected on the base of given traits (resistance, adaptation to particular soils, ecc.);

Collection of cuttings: softwood cuttings (from 3-4 to 15-20 cm long), are collected in the lowest part of the crown;

Best season: plants not completely growing (November, or March-April according to others); each genotype express a different rooting potential;

Treatment with a root promoting compound (IBA) (dipping the leaf-free base of cuttings for a few seconds): its effect depends on genotypes;

Cuttings are placed on a bottom-heated bench (22-24°C) in a mist greenhouse; inserted 4 cm in the substrate (1/3 L);

Rooting occur in relative long time (mean 4 months) depending on: age of the mother tree, collecting period of cuttings, genotype, management.

Hardening

Rooted cuttings are transplanted in 5 cm (100cc) pots, containing peat, sand and perlite (3:1:1 in vol.);

Acclimation at 22°C on the bench in mist greenhouse for 4 weeks;

Transplanting in 1,5-2,5 l pots containing mould, peat, sand (2:2:1 in vol.) then plants are kept under a shading net for 1 year.

Survival (success of rooting) can be evaluated after the second transplanting.

2-years-old self rooted cutting are generally 38-42 cm tall.
Case study 1

Propagation of monumental trees of particular landscape value sites (Val d’Orcia)

- Selection;
- Classification;
- Propagation;
- Evaluation of their response to bark canker;
- Apply for a patent;
- ‘Le Crete 2’ is a canker resistant variety patented in 2010.

Case study 2

Aim is the stabilization of soils on pliocenic clayey substrate (crete).

Regional project ARSIA - Prov. Siena – CNR:

- Selection and propagation of trees showing adaptation to this kind of soil;
- Self-rooted cutting propagation of 50 canker resistant clones (selected by IPP);
- Transplanting in experimental fields located in pliocenic clayey soils in the province of Siena;
- Evaluation of their tolerance to clayey soils and of their rooting potential;
- Use of the better clones, eventually as rootstock as well, for protective plantings in clayey soils.
Forest of Mediterranean cypress in the Samaria Gorge - Crete - Greece