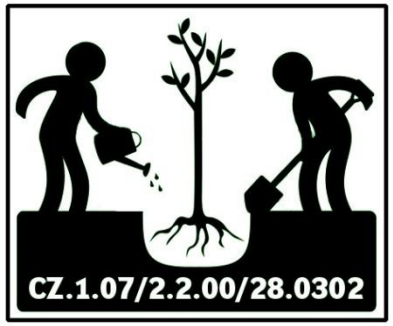
INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



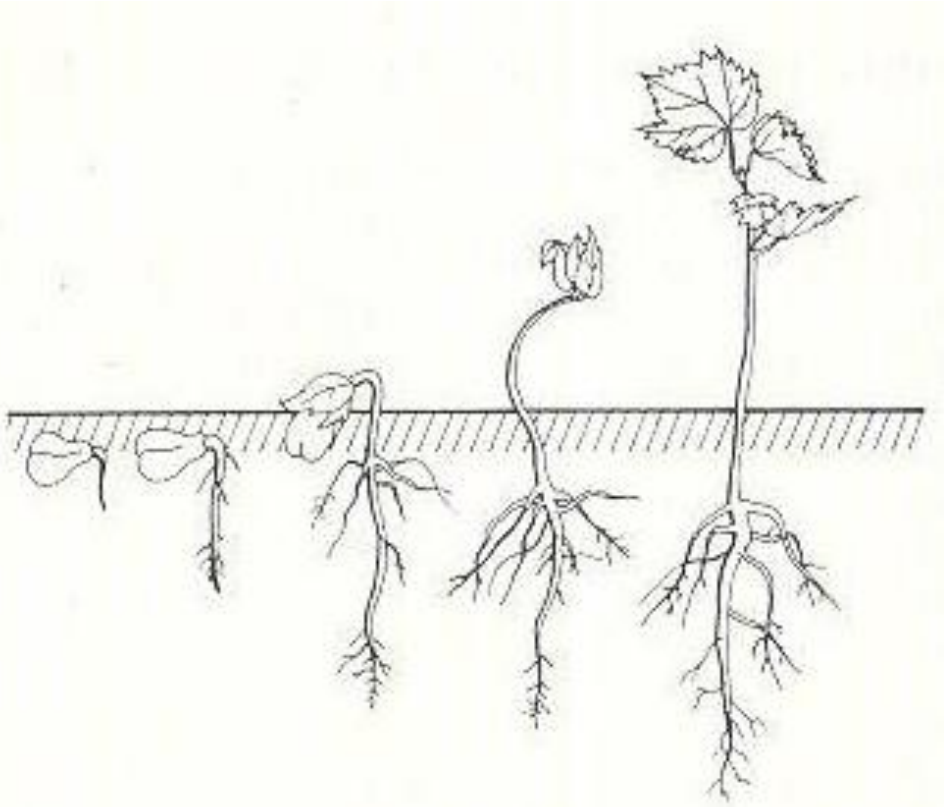
Inovace studijních programů AF a ZF MENDELU směřující k vytvoření mezioborové integrace CZ.1.07/2.2.00/28.0302

Tato prezentace je spolufinancovaná z Evropského sociálního fondu a státního rozpočtu České republiky

Propagation of Grapevine

- Generative propagation: From seeds, used for cultivation of new varieties
- Vegetative propagation: From plant parts
  - Direct: Hardwood cuttings, greenwood cuttings, layering, layering of the whole vine
  - Indirect: Grafting (most common technique)
    - Grafting using rootstock
    - Grafting on the vineyard site – changes of a grapevine variety

Generative propagation:
Acquisition of seeds, stratification, sown in spring, tying of annual shoots during growing season



Seeds germination

Seedlings differ in morphological and physiological characteristics; high variability

Vegetative propagation: Seedlings retain characteristics similar to the mother plant Grapevine seedlings:
- Grafted: Rootstock and a scion
- Rootstock: For planting of rootstock vineyard
- Self-rooted: Cuttings from one-year old wood

Act No 321/2004 Sb. stipulates that all newly established vineyards must use officially authorized seedlings from two components – a rootstock and a scion.

European grapevine has large intercellular spaces whereas American types of rootstock: vitis rupestris, vitis riparia, vitis berlandieri – have smaller intercellular spaces and thus are less prone to phylloxera.

Propagation from cuttings

- Length of the cutting – one-year old vine shoots, depends on soil:
  - Heavy soil: 0.25 m
  - Medium-heavy soil: 0.30-0.40 m
  - Sandy soil: 0.40-0.50 m (cuttings should be mechanically anchored in the soil, more reserve substances)
- Cuttings are taken in autumn, after first frosts
- Buds are removed, except for a top bud forming an annual shoot later (leave a 15 mm long stub above the bud)
- Bottom part of the cutting is cut just below a bud
- Must be followed by
  - Stratification
  - Forcing
  - Nursery: Seedling is ready in the autumn

Propagation from bud cuttings

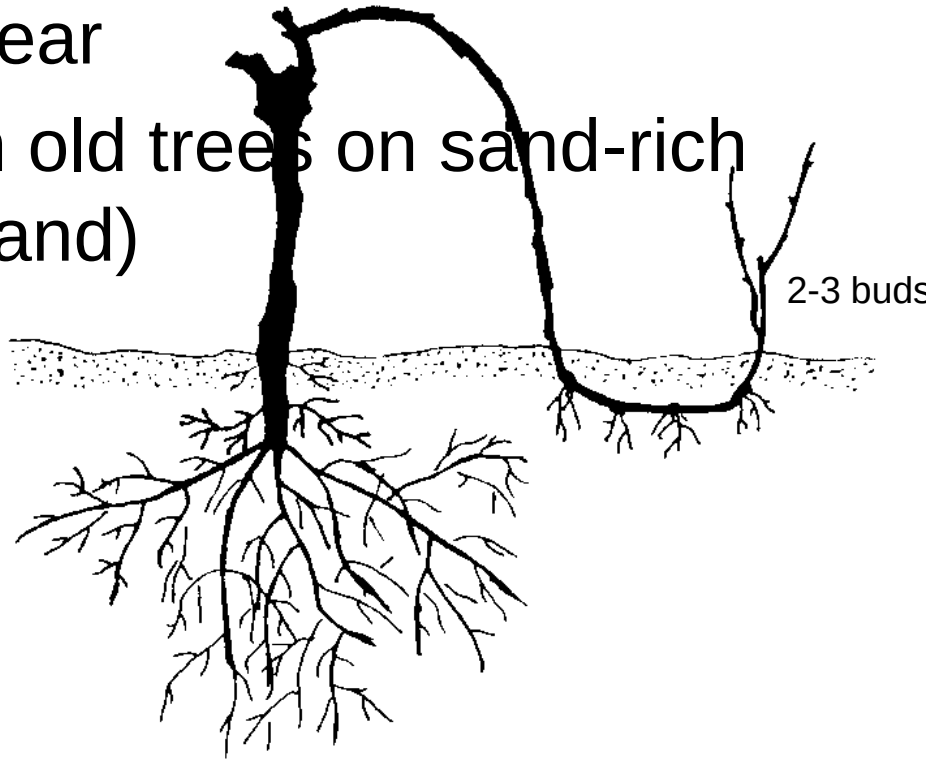
- Short cuttings: One, two or three buds
- Bottom cut just below the bud, top cut just above the bud (15 mm)
- Cuttings root in a substrate:
  - Moist sand
  - Temperature 30 °C
  - 80 % humidity

Propagation from green cuttings

- Optimum time for taking - just before blooming (annual shoots which are not lignified)
- 2 (1) bud cuttings (6-12 cm)
- Bottom cut just below the bud, top cut just above the bud (15 mm)
- Substrate:
  - Moist sand
  - Covered with a PVC foil, prevents evaporation

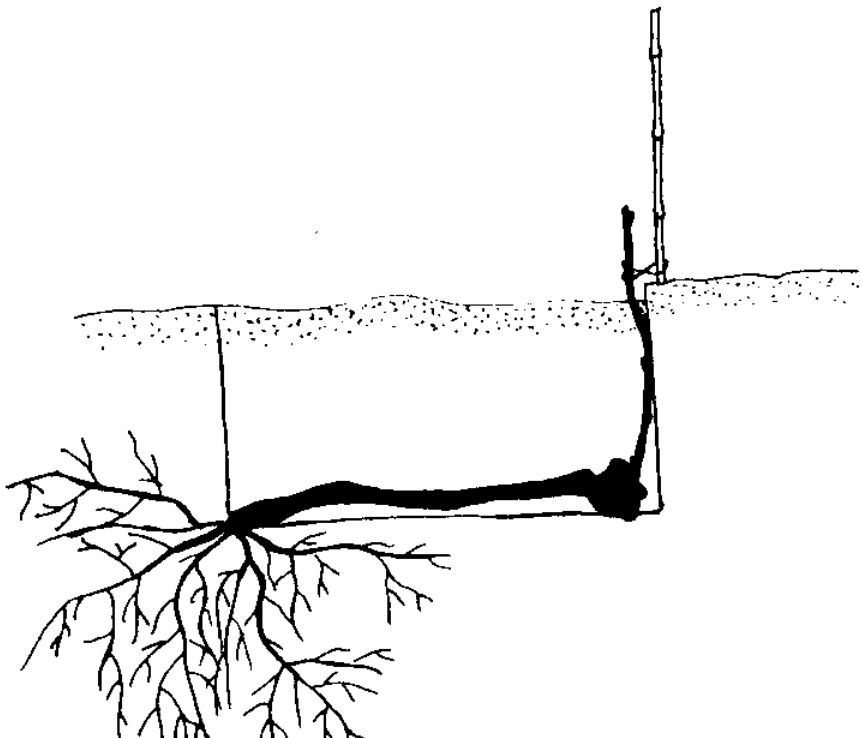
Propagation by layering

- One-year old vine shoots are buried in soil (30 cm)
- 2- to 3-bud stubs are above the ground
- Buried part of the plant will root, stubs will form annual shoots
- Separated in a second year
- To grow new canes from old trees on sand-rich soils (60-70 % of silica sand)



Propagation from layering of the whole vine

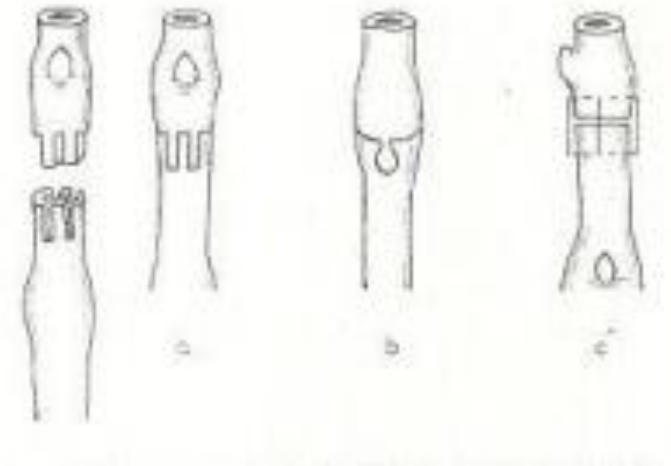
- The whole plant together with the head is bent and covered with soil
- Only one-year old vine shoots root
- Separated in the second/third year
- Vine plant may be erected above the ground again



Propagation using grafting

Timing, technique and place of grafting:

- Indoor grafting (in a hall, facility)
  - Manual
  - Mechanical
- Grafting on the vineyard site
  - During dormancy
  - During a growing season



Timing of grafting (using rootstock)

- Winter grafting
- Jan, Feb
- Only if there is enough grafting material (few labourers)
- Requirements: Stored at 6 °C until transplanted
- Spring
- Mar, Apr
- Optimum for continuous work flow:
- Grafting – stratification – hardening - transplanting

Manual grafting

- From Jan till Apr, tongue whip grafting
- Preparation of cuttings (rootstock)
- Cuttings length (0.35-0.38 m, 6-8 mm thick)
- Buds are removed
- Cut below the bud
- Disinfection (0.5 % Chinosol)
- Stored at 0-2 °C
- Soaked in water for 24 h before grafting

Preparation of scions

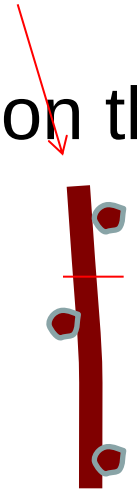
- Optimum timing – early winter
- Medium part of the vine shoots, 10 buds
- Bundles of 100 pcs, tags
- Disinfection, storage, good health
- Scions are adjusted
- 15 mm above the bud
- 50-60 mm below the bud (1-bud scion)
- Soaked in water for 24 h before grafting

Technique of tongue whip grafting

- Two botanically close parts are connected
- Bottom part – the root stem – makes up the rootstock
- Top part – the scion – is the variety
- Both parts are of identical thickness; cut slantwise below the bud, length: 1.5 of vine shoot length (15-20 mm below the bud)

Tongue whip

Alteration of buds on the rootstock and the scion



Mechanical grafting

Grafting devices

- Various types: PM-450, Duffee, Wagner, Pfropf-Star
- Omega-shaped cuts
- Foot pedals

Technology of mechanical grafting

Removal of rootstock buds, renewal of cut below the bud

Příprava roubů a podnoží

Soaking of rootstock (cuttings)

Scion soaking, 1-bud stubs

Grafting

Working table: Scions, rootstock
Mechanical grafting (omega-shaped cuts)

Petroleum waxing (1)

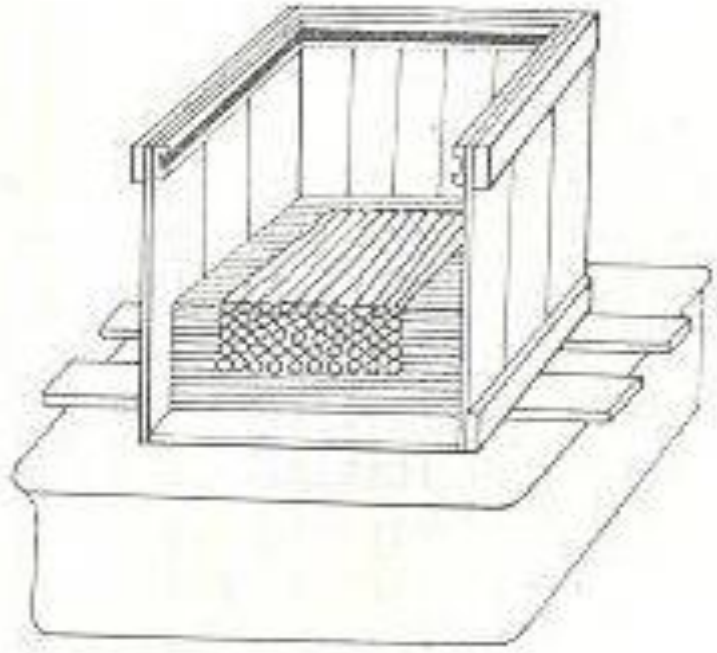
- Top part of the grafted plant is submerged in petroleum wax (Revilan), 65-70 °C, and immediately placed in a cold water bath, rapid cooling

Stimulation

- Enhances results of rooting cuttings
- Basal part is submerged into a stimulator (solution, powder)
  - Indole-3-acetic acid (IAA)
  - Indole-3-butyric acid (IBA)
  - 1-naphthaleneacetic acid (NAA)

Stratification

- Creating optimum conditions for formation of occlusion along the whole cut perimeter
- Grafted plants are stored in stratification boxes immediately after grafting, and covered with sawdust
- Temperature before forcing: 2-4 °C



Stratification box


Foil preventing
dryness
4. 4. 1995


4. 4. 1995


Loading of boxes into a
booth
4. 4. 1995

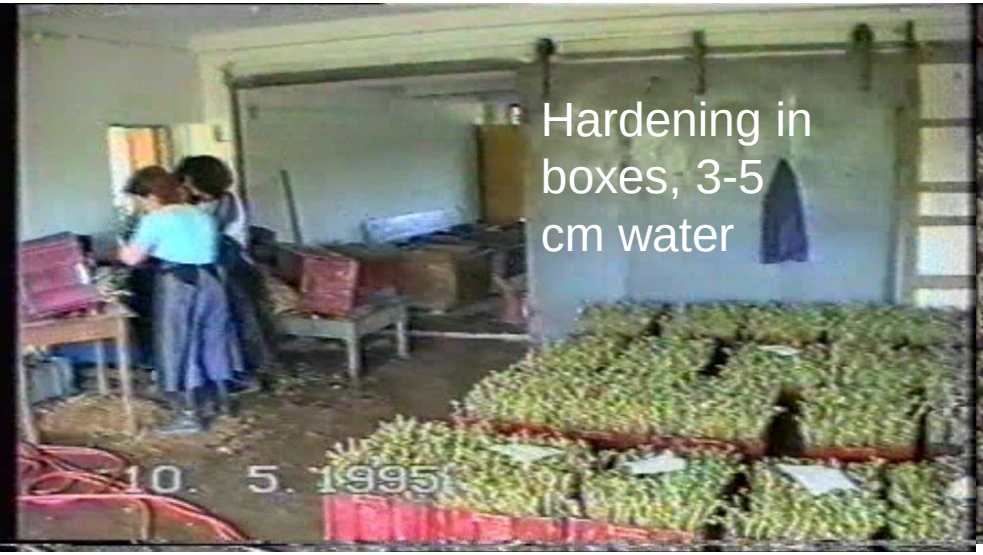
Stratification technique

- First 3-5 days in the boxes – high temperature (28-30 °C), ambient temperature: 30-40 °C, greenhouses, halls
- Later, temperature decreases to 24-26 °C
- Once a callus on wounds is formed, temperature is decreased to 20-21 °C
- Roughly 9th day - sprouting, top layer of sawdust with the foil is removed, temperature is decreased (by 2 °C a day), amount of light is increased, ventilation – temperature decrease to 10-14 °C (ambient temperature)
- 16th day: hardening begins, PE boxes with water
- Stratification together with hardening lasts ca 20 days

Removal of surface roots

Hardening, petroleum waxing (2)

- Second round of petroleum waxing and transplanting follows after hardening



Hardening in boxes, 3-5 cm water

Transplanting of grafts

- After May frosts (soil temperature: 10-12 °C), mid-May
- Grafts are transplanted into strips of a black mulching foil, 0.10 m deep
- Row spacing: 1.5-2 m, spacing of plants: 6-7 cm
- 60-100 THS pcs per 1 ha
- Irrigation
- Rootstock starts to grow roots
- Annual shoots grow from the waxed scions which are regularly treated for fungi diseases


10. 5.1995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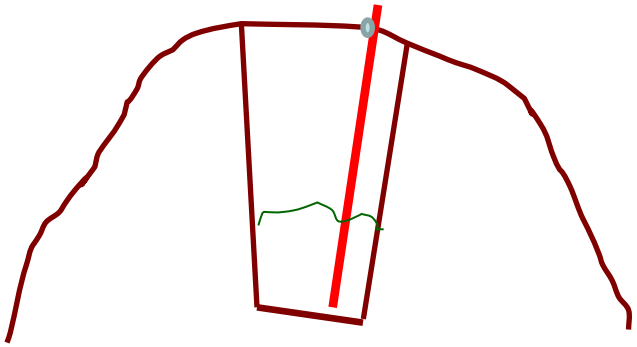
- Black foil is removed in mid-August (soil dries out better, maturing is quickened)
- Yield: ca. 60 % of grafted seedlings of the first grade quality

Previous methods of transplanting:

- Ridge planting: Ridges are ploughed in autumn, holes (0.40-0.45 m deep) are dug in spring, grafts are transplanted into thoroughly irrigated soil
- Trench planting: Grafts are transplanted into trenches, bottom of the trench is well disintegrated, and may be filled with compost



Novel methods of transplanting:

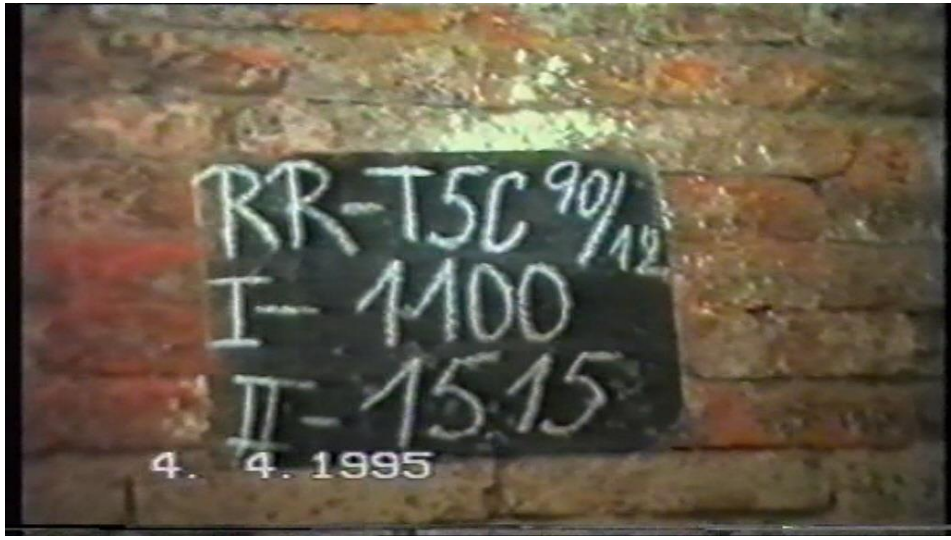
- Planting in plastic greenhouses: 2 rows, grafts are forced (after harvest of early vegetables)
- Hydroponic solutions – use of substrates: perlite, sand, gravel – nutrient solution, weak concentration – water and nutrients (1x), pH 6.3, in the middle of the growing season: nutrient solution of water and nutrients (2x), less developed root system
- Growing in containers: Grafts are planted in containers at the vineyard site at the end of May; second grade quality, weaker seedlings may be cultivated

Quality of grafts is affected by cropping practices at the grapevine nursery (quality of soil, irrigation, and fertilization)

- Soil cultivation: Every 14 days, keeps good soil structure, prevents evaporation, destroys weed
- Irrigation: Beginning of transplanting - small daily doses of 8 mm, during growing - 4-5 doses of 25-30 mm
- Removal of surface roots: Used in older types of nursery planting (ridges, trenches, scion is covered with soil, surface roots grow from the scion), twice per growing season: First removal: Ridges are renewed in July; ridges are not renewed after second round of removal of surface roots, enhancement of annual shoot hardening

- Pests and diseases protection: Highest damage rate - grapevine downy mildew and grapevine powdery mildew; preventive chemical spraying, every 2 weeks
- Application of nitrogen fertilizers
- Cutting of annual shoots: More than 0.6 m long, cuts will enhance strengthening and maturation of the annual shoots (first cut in Aug, second at the end of Sep)

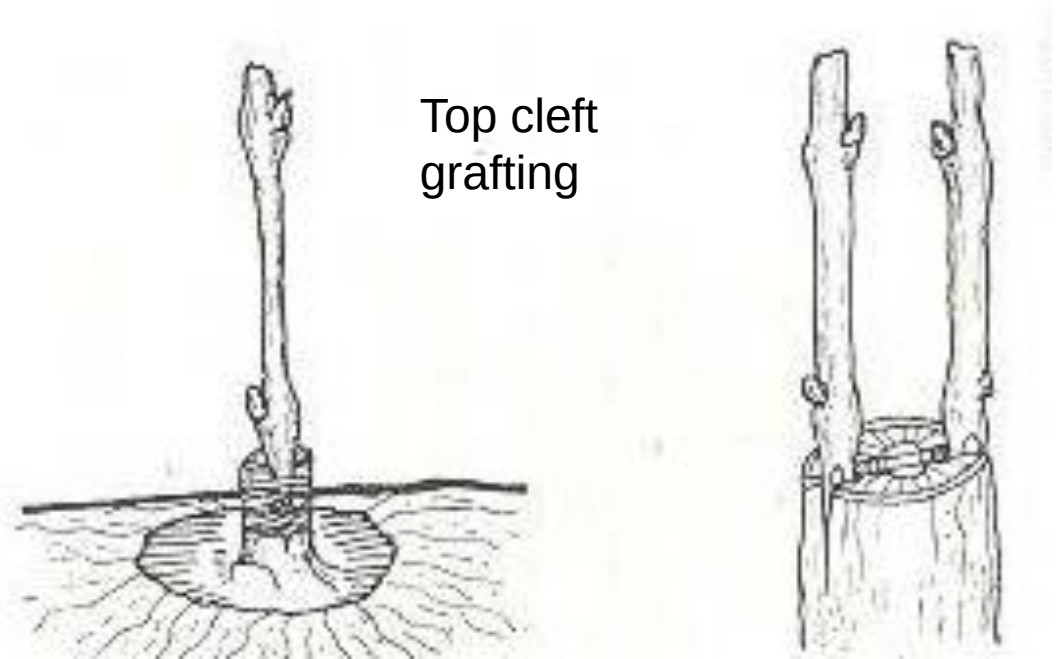
- After the growing season, seedlings are ploughed with a specially adjusted plough
- Seedlings are bundled, surface roots are removed before sorting
- First grade quality: Roots grow evenly along the whole perimeter, 0.15 m long, sprout: 0.2 m long, 5 mature buds
- Sorted seedlings: disinfection, 0.3 % Chinosol
- Nursery products storage site – cellars, sand
- 2-5 °C storage temperature



Constant temperature - max. 5 °C

Grafting on the vineyard site

- Replacement of unsuitable varieties producing little fruit
- Grafting before bud break and during dormancy:
  - 1. Top cleft grafting, oldest technique
  - 2. Side bark grafting

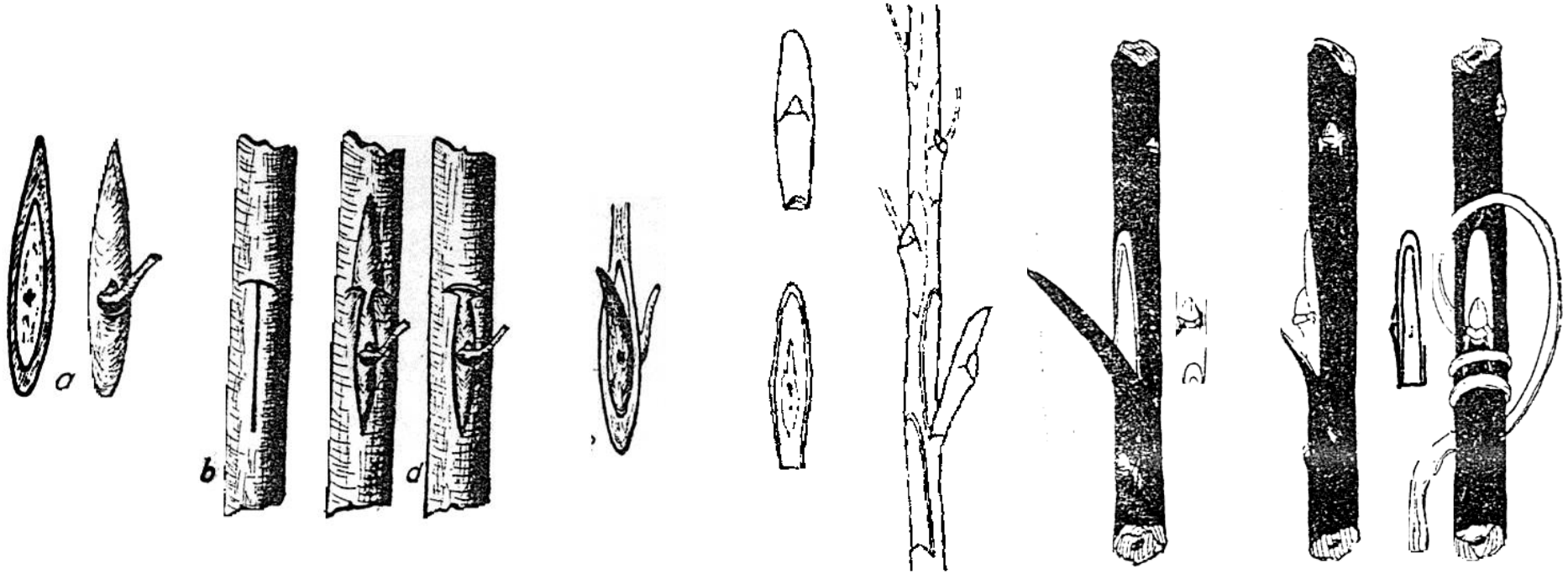


Top cleft grafting

- Rootstock is exposed all the way up to the soil surface
- Cambium of the rootstock and the scion must be placed in contact with each other

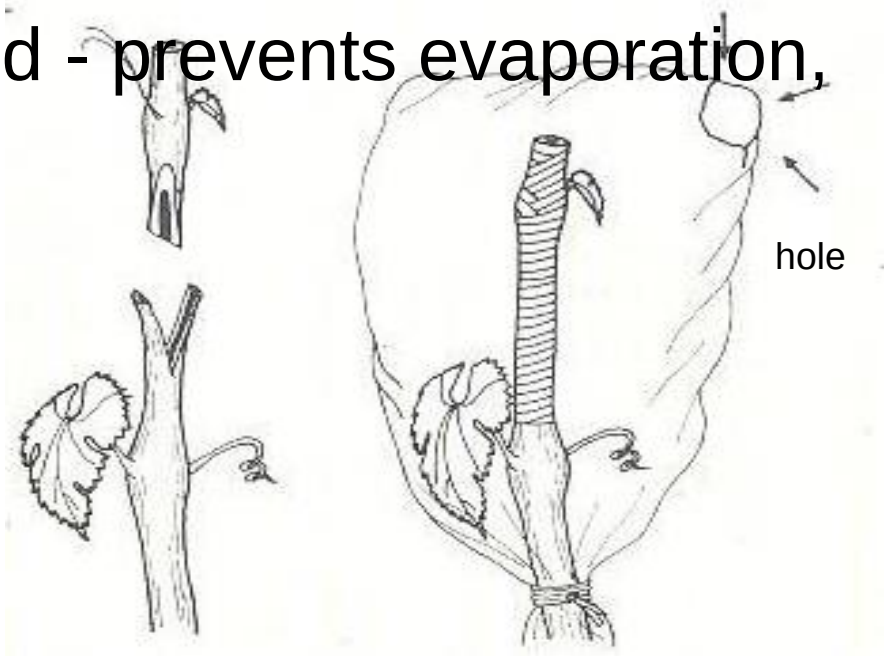
3. Budding of one-year old shoots

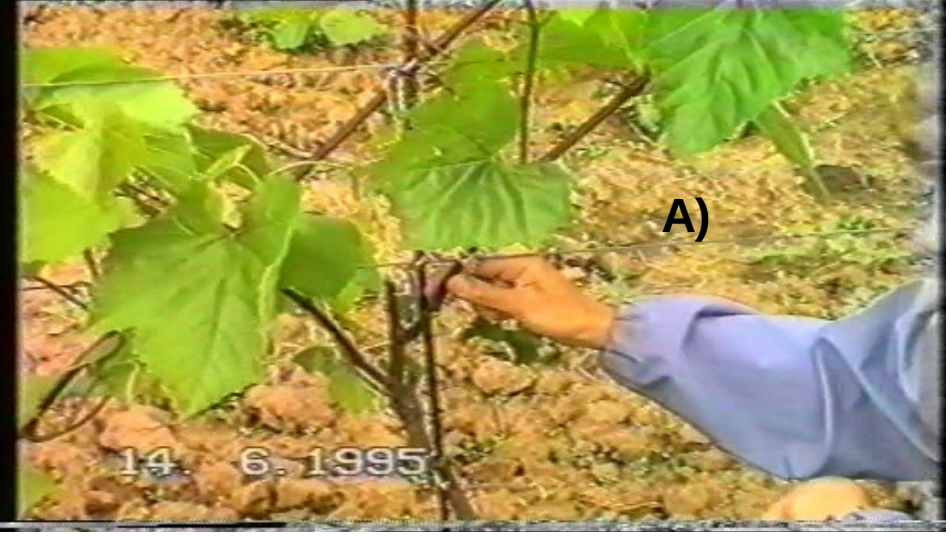
- End of May or mid-June, hardwood scions
- T-budding and chip budding (Forkert method of budding)
- Existing trunk is cut in early spring of the following growing season to see if the budded annual shoot wintered



4. Grafting of green annual shoots

- Vigorous annual shoots, end of May and early June – change from softwood phase to hardwood phase
- Grafting of hardwood scion (taken during dormancy)
- Top cleft grafting, PVC taping
- PE bag may also be used - prevents evaporation, keeps moisture





Sampling of annual shoots for grafting – A) From the trunk, B) From the rootstock stem Pinching provides better maturation of basal part (May), tying to the support

preparation of hardwood scions, soaking in water (12 h)
Shortening of the annual shoot – var. A) Grafting of annual shoots on the trunk – early June
Removal of buds on the rest of the annual shoot

Cutting of rootstock (grafted varieties) – a cleft
Cutting of hardwood scion – top grafting
Insertion of the scion into the cleft of the rootstock

Taping with a PVC tape, twisting, and a loop

Var. B) Point of cutting of the annual shoot growing from the rootstock – early June (at the bottom wire) rootstock and scion bud - location Taping of grafting union

Sprouting scion bud
Removal of annual shoots growing on the rootstock and the trunk (below the graft union)

Following year: Bearing annual shoot with inflorescence
Removal of PVC tape
Removal of annual shoots from the rootstock and the trunk

Removal of auxiliary buds
Support for the annual shoots - double wires
Thorough removal of annual shoots from the trunk and rootstock

Retractable machine part