



INVESTICE DO ROZVOJE VZDĚLÁVÁNÍ



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GRAPEVINE ROOTSTOCK

Phylloxera outbreak in 19th century infested the whole Europe, basically all vineyards were destroyed and later replanted with newly grafted seedlings.

Interspecific hybrid wine grapes - American-American and French-American - new, more resistant rootstock.

New rootstock has better:

- Compatibility (better interaction of rootstock and a graft)
- Affinity (Rootstock and the graft adapt easily to each other)
- Adaptation (Rootstock adapts to conditions at a given vineyard site, to its soil, climate and cropping practices)

Original grapevine native to America – rootstock

Riverbank grape (*V. riparia* Michx.)

Resistant to phylloxera and fungi diseases, good resistance of the root system to winter frosts. Flourishes in deep, aerated, humus-rich and moist soils with little calcium (max. 6 %). Common in Czechia in the past: *Vitis riparia* Portalis (syn. Gloire de Montpellier). Good for northern winemaking regions, short growing season. Low vigour – not cultivated anymore.

Sand grape (*Vitis rupestris* Scheele) Saint George

Resistant to phylloxera and fungi diseases. Prolongs growing season and delays ripening of grafted grape varieties. Tolerant to calcium-rich soil (max. 12 % of active calcium). Unsuitable for northern regions.

Spanish grape (*V. berlandieri* Planch)

Long growing season, tolerant to lime soils (max. 40 % of active calcium). Rather low resistance to phylloxera, good resistance to fungi diseases. Root system has little resistance to winter frosts. Little compatibility with European grape varieties.

Interspecific American-American hybrids

Most of the rootstock used today comes from crossing of *Vitis berlandieri* Planch X *Vitis riparia* Michx

Kober 5BB

High vigour, good resistance to phylloxera, very good to nematodes, medium to high resistance to drought. Good for loamy and gravelly soils; productive varieties with low vigour (Muller Thurgau, Veltliner, Pinot Blanc, Pinot Gris, Pinot Noir, Chardonnay, Portugieser and Andre) benefit from soils with little calcium (max. 15 %).

Craciunel 2

High vigour, resistant to drought. High resistance to phylloxera. Good for light, sandy and gravelly soils. Not suitable for heavy, clay soils. Tolerates higher calcium concentrations in soil (max. 20 %). Grafting of varieties sensitive to blossom fall.

Kober 125 AA

Vigorous growth, varieties grafted on Kober 125 AA have lower vigour than varieties grafted on Kober 5BB. Good for moist and sufficiently deep soils. Dry vineyard sites are not suitable. Tolerates max. 14 % calcium in soil.

Teleki 5C

Medium vigorous growth, very good resistance to phylloxera, tolerant to powdery mildew and downy mildew. Good for loamy soils, tolerant to higher concentrations of calcium. Not good for cold, sandy and moist soils. Good for varieties sensitive to blossom loss.

SO 4 (Oppenheim)

Medium vigour, high resistance to phylloxera, resistant to nematodes. Tolerates high calcium concentrations (18 %). Good for humus, evenly moist soils. Not good for light and low-productive soils. Suitable varieties: Rhine Riesling, Neuberger, Silvaner, Veltliner and St. Laurent.

Hybrids from crossing of *Vitis riparia* Michx X *Vitis rupestris* Scheele

Schwarzmann

Low vigour, high resistance to phylloxera. Good for sandy-loamy and loamy, slightly moist soils. Low tolerance to calcium (7 %), good tolerance to drought. Decreases blossom loss and improves productiveness of the grafted variety. Delays grape ripening and wood maturity. Used for medium high training.

Hybrids from multistage interspecific crossings

LE-K/1 (/Vitis riparia X Vitis rupestris/ X Ortliebske) X St. Laurent

Very high vigour, low resistance to phylloxera. Good for sandy, gravely and skeletal soils. Good resistance to drought. Intolerant to soils high in calcium (max. 7 %). Good affinity to all varieties. Good for very productive varieties, such as Veltliner, Rhine Riesling, Muller Thurgau and Zweigletrébe.

AMOS (Malingre X Vitis amurensis) X (Vitis riparia X Vitis rupestris)

High vigour, good maturity, good affinity with most varieties. Good for light and well drained loamy-sandy and loamy soils. Intolerant to soils high in calcium (max. 10 %). Replaces Schwarzmann rootstock.

Particular criteria for selection of rootstock

Properties of grafted varieties

Very productive varieties: Kober 5 BB, Kober 125 AA, LE-K-1, Amos, G 26

Low vigour, for enhancement of the vine vigour: see above

Varieties susceptible to blossom loss: SO 4 and/or G 26

Medium vigour, loamy soils, medium training: 5 C and/or CR 2

Soil properties

Max. 10 % of active calcium

-Sandy, draining soils: K 1, Amos and/or CR 2

Loamy, medium-moist soils: most of rootstock, variety-dependent selection of rootstock

Heavy soils: 125 AA, 5 C, G 26

Soils rich in calcium (10-20 %)

Draining soils: 5 BB, CR 2, Fercal, 8 B

Loamy, medium-moist soils: 5 C, 5 BB, 125 AA, CR 2, SO 4, G 26

Marlaceous, heavy, lime soils: 125 AA, 5 C, Fercal, 8 B

Rootstock for particular varieties

Rhine Riesling: SO 4, 5 C, 125 AA, K 1, G 26

Pinot Blanc: 5 C, SO 4, 5 BB

Pinot Gris: Good soil – SO 4 and/or 125 AA, less favourable soil – 5 BB, CR 2

Chardonnay: 5 C, SO 4, 5 BB

Traminer: SO 4, 125 AA

Sauvignon: SO 4, 5 C, also 5 BB on skeletal and sandy soils

Muller Thurgau: 5 BB, 125 AA, 5 C

Veltliner: 5 BB, CR 2, K 1, SO 4

Rhine Riesling: 5 BB, 125 AA, SO 4 and/or K 1

Neuberger: SO 4

Silvaner (green and red): 5 BB, SO 4 and/or 125 AA

Pinot Noir: SO 4, 5 C, dry sites also 5 BB

Limburger: 5 BB

Merlot: 5 C, SO 4 and/or 3309 C

Cabernet franc: SO 4, 5 BB

Cabernet Sauvignon: SO 4, dry sites also 5 BB

Aurelius: 5 BB

Kerner: 5 BB, SO 4

Portugieser: 5 BB

St. Laurent: 5 BB, 5 C and/or SO 4

Zweigeltrebe: 5 BB

Andre: 5 BB

Neronet: G 26, 5 C, 5 BB

Dornfelder: SO 4, 5 C, 5 BB

Domina: SO 4, 5 C, 5 BB

Rootstock nursery

Plantation site: Mild southern and south-eastern slopes, 5-8° angle. Protected from strong northern winds, suitable for machinery.

Temperature: Mean daily temperature for good growth, development and maturity of wood is min. 10 °C. Sum of active temperatures is min. 2,200 °C.

Elevation: The higher the elevation, the shorter the growing season (wood matures poorly).

Optimum elevation: max. 250 m.

Precipitation: Optimum ranges 600-800 mm. Distribution must be even, promotes bud break in spring and shoot growth during growing season.

Soil: Warm, adequately moist, enough nutrients; optimum: sandy and loamy-sandy soils.

Spacing: Rootstock vines require trellis systems to develop erect, healthy and vigorous rootstock. Optimum spacing: 0.8-1.0-3.0 m. 3,300-5,000 plants per 1 ha. Orientation of rows: north, south.

Most suitable training systems:

Bratislava-style training (low training) – supports are 2.5-3.00 m high, 6.00-8.00 m apart, spacing: 2.5-1.2-1.5 m. Main wire is stretched at the very top of the posts and wires are attached to the stake (50-60 °angle). Rows orientation: north, south (full light perception).

Bratislava-style training for grapevine rootstock plantations

Reduction of rootstocks: single or double lengths

Chmelnicove training (high training) – Posts are 4-5 m tall, connected at the top with a wire. Wires are attached to the vines and are anchored in the ground. End posts function as anchors and are positioned in the opposite direction of the wires. One-year old vine shoots are properly mature. Tying of shoots is time-consuming and difficult. Shoots must be tied to the wires several times per growing season.

PROCEDURE FOR ESTABLISHING A ROOTSTOCK NURSERY

- Basic fertilization, nutrient content is modified to suit the soil needs – liming, cover plants (soil analysis)
- Trenching (0.6-0.7 m deep), followed by soil dragging, establishing row spacing and plant spacing
- Seedlings – only one-year old seedlings, excellent condition, healthy:
 - One-year old vine shoots are cut to one normally developed bud
 - Roots are cut to 40-80 mm

- Planting of the rootstock – manual, drilling devices. Bottom of the holes are filled with compost, seedlings lean to the stakes. Seedling top is 30-50 mm above the soil surface.
- Timing of the planting: autumn, spring

Treatment of the plantation – year 1

Following work must be done:

- Surface disintegration of soil
- Management of the ridges
- Elimination of dewing (surface) roots
- Canopy and floor management

Soil in the interrows must be cultivated 4-5 times. Shoots mature towards the end of July and the ridges may be eliminated. Surface roots are removed once/twice per growing season.

Work during a growing season:

- Tipping of shoots tips and elimination of lateral shoots
- Tying of shoots to the wires

Treatment of the plantation – year 2

After pruning:

- Remove the soil
- Perform corrective pruning
- Tie and remove lateral shoots
- Disintegrate surface soil

Corrective pruning – leave one-bud spurs. Year 2 – leave more shoots (3-4). Thin out lateral shoots during growing season (they must not lignify), remove tendrils and tie shoots to the stake (every 10 days). If the vine grows slowly, consider additional fertilization. Establish a trellis system.

Treatment of the plantations in following years

Full productiveness should start in year 4. Shoots from one-bud spurs grow sooner, more vigorously and they mature better than shoots from dormant buds. Eliminate all dead vine parts after pruning. Leave 5-7 shoots per 1 vine. Remove unnecessary shoots (0.25-0.3 m). Shoots must be tied regularly to the support; lateral shoots are removed (not lignified, 50-100 mm long). Main shoots terminate their growth at the end of growing season – cut the tips above the support system. Soil disintegration provides enough air and enhances water intake.

VINE SHOOT HARVEST

Mature vine shoots have a typical colour. Early frosts may prematurely terminate the growing season and stop maturation of the shoots.

Maturity features:

- Bark colour
- Vine shoots crack when bent
- Tissues are developed

Harvest starts when temperatures drop below -10 °C. Immature parts of the one-year old wood freeze and dry out. Prune vines 40 mm above the last node. Vines shoots are removed from the wires and stored in bundles with other shoots.

Processing:

Elimination of lignified tendrils, remaining lateral shoots, immature and dry vine parts

Sorting:

- 1st grade quality: Erect, healthy, properly matured and undamaged shoots, 6-10 mm in diameter
- 2nd grade quality: Erect, healthy, properly matured and undamaged shoots, less than 6 mm and more than 10 mm in diameter

Basic length of the cutting: 0.45 m; twice the length (0.9 m) as well as five times (2.25 m) the length of the cutting may be used; cuttings are bundled and labelled.

Storage: Cooling boxes, temperature cannot rise above 2 °C, humidity: 80-90 %. Air flow prevents fungi diseases and moulds. Soaking of cuttings in 0.5 % solution of chinisol, cryptonol. Yield: 65,000 pieces per ha on average (planned yield 100,000 pieces per ha).

STORAGE OF SEEDLINGS, HANDLING AND PLANTING

Requirements on planting stock:

- First-class seedlings have a compact graft union
- Good maturity of basal shoot buds, length of seedling shoots is not important
- Root stem is 0.35 m long, no mechanical damage
- At least three roots on the taproot, evenly along its perimeter

Winter storage: 1-2 °C, seedlings are freely stored in bundles (25-50 pcs). High air humidity, use of disinfection (grey mould). Roots are laid opposite each other, each layer of the seedlings is covered with sand. Sand humidity as well as air humidity is controlled throughout the winter.

Preparation of the seedlings for planting: cane is cut to 1-2 buds, roots are cut to 30-40 mm (planting using a hydraulic digger) and 50-80 mm (planting using a machinery and manual planting). Upper parts of the seedlings are waxed (60-70 °C), which prevents drying. If the seedlings are not waxed, they must be soaked 1-2 days prior to planting in water.

Planting: mid-April till mid-May. Autumn planting is also plausible (no irrigation necessary, good for the seedlings). Seedlings are covered with soil to prevent frost-damage.